

Regulatory Economic Analysis

For

**Lowering Miners' Exposure to Respirable Coal Mine Dust
Including Continuous Personal Dust Monitors**

Final Rule

(RIN 1219-AB64)

U.S. Department of Labor
Mine Safety and Health Administration
Office of Standards, Regulations, and Variances

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I. EXECUTIVE SUMMARY

INTRODUCTION

Chronic exposure to respirable coal mine dust causes lung diseases including coal workers' pneumoconiosis (CWP), emphysema, silicosis, and chronic bronchitis, known collectively as "black lung." These diseases can result in disability and premature death. Based on data from the National Institute for Occupational Safety and Health (NIOSH), new cases continue to occur among coal miners. The prevalence rate (Laney, 2010, p428) and incidence (Beekman, 2001, p635) of lung disease is increasing in our nation's coal miners despite the fact that incurable black lung is preventable. Additionally, young miners are showing evidence of advanced and seriously debilitating lung disease from excessive dust exposure.

Over the decade 1995-2004, more than 10,000 miners died from black lung. Furthermore, as of December 2011, according to the Department of Labor's Office of Workers' Compensation Programs, Division of Coal Mine Workers' Compensation, the federal government has paid over \$44 billion in Federal Black Lung benefits to beneficiaries (former miners, widows, dependents) since 1970. This final rule will reduce coal miners' occupational exposure to respirable coal mine dust. As a result, it will lower their risk of developing black lung disease and suffering material impairment of health or functional capacity.

BACKGROUND

MSHA's existing standards require coal mine operators to continuously maintain the average concentration of respirable dust to which each miner is exposed during each shift at or below 2.0 mg/m^3 . Miners who have evidence of pneumoconiosis and are employed at underground coal mines or surface work areas of underground coal mines have the option to work in areas where average respirable dust concentrations do not exceed 1.0 mg/m^3 .

Under MSHA's existing standards, underground and surface coal mine operators are required to collect bimonthly respirable dust samples and submit them to MSHA for analysis to determine compliance with applicable respirable dust standards. Compliance determinations are based on the average concentration of respirable dust measured by five valid respirable dust samples taken by the operator during five consecutive normal production shifts or five normal production shifts worked on consecutive days. If the average of operator samples exceeds the applicable dust standard, MSHA issues a citation for a violation of the standard. For MSHA inspector samples, compliance determinations are based on the average of multiple samples taken over a single shift or on the average of samples collected over multiple shifts on the same occupation.

SUMMARY OF THE MAJOR REQUIREMENTS OF THE FINAL RULE

The final rule contains the following major provisions:

- *Lowers the Existing Concentration Limits for Respirable Coal Mine Dust.* The concentration limits for respirable coal mine dust are lowered 24 months after the effective date of the final rule, from 2.0 mg/m^3 to 1.5 mg/m^3 at underground coal

- mines and surface coal mines, and from 1.0 mg/m³ to 0.5 mg/m³ for intake air, and belt air courses when used as section intake air courses at underground coal mines, and for part 90 miners. Lowering the concentration of respirable coal mine dust in the air that miners breathe is the most effective means of preventing diseases caused by excessive exposure to such dust.
- *Requires the Use of the Continuous Personal Dust Monitor (CPDM).* Eighteen months after the final rule takes effect, the final rule requires the operator to use the Continuous Personal Dust Monitor (CPDM) to monitor the respirable coal mine dust exposures of underground coal miners in occupations exposed to the highest respirable coal mine dust concentrations and part 90 miners. Use of the CPDM is optional at surface coal mines (except for sampling part 90 miners), non-production areas of underground coal mines, and underground anthracite mines using full box, open breast, or slant breast mining methods. The CPDM is a new sampling device that measures continuously, and in real-time, the concentration of respirable coal mine dust and provides sampling results at specific time intervals and at the end of the work shift.
 - *Redefines the Term “Normal Production” Shift.* The term normal production shift is redefined to require that underground coal mine operators take respirable dust samples in a mechanized mining unit (MMU) when production is at least 80 percent of the average production over the last 30 production shifts. Under the existing definition, underground mine operators are required to sample when production is at least 50 percent of the average production reported during the operator’s last sampling period (i.e., last set of five valid samples).
 - *Requires Full-Shift Sampling.* The final rule requires the operator to collect respirable dust samples for the full shift that a miner works. If a miner works a 12-hour shift, respirable dust samples must be taken with an approved sampling device for the entire work shift, rather than only a maximum of 8 hours as required under the existing standards. Full-shift sampling provides more representative measurements of miners’ respirable dust exposures and increases their health protection.
 - *Changes the Averaging Method to Determine Compliance on Operator Samples.* Under existing standards, corrective action is required after the average of five operator samples exceeds the respirable coal mine dust standard and a citation is issued. This permits specific instances of miners’ being exposed to high levels of respirable coal mine dust without requiring any corrective action by the operator to reduce concentrations to meet the limit. The final rule requires immediate corrective actions to lower dust concentrations when a single, full-shift operator sample meets or exceeds the excessive concentration value (ECV) (citation level) for the applicable dust standard. These corrective actions will result in reduced respirable dust concentrations in the mine atmosphere and, therefore, will provide better protection of miners from further high exposures.
 - *Provides for the Use of MSHA Single, Full-Shift Samples to Determine Compliance.* MSHA inspectors will use single, full-shift samples to determine noncompliance with the respirable dust standards. MSHA has determined that the average concentration

of respirable dust to which each miner in the active workings of a coal mine is exposed can be accurately measured over a single shift.

- *Expands Medical Surveillance Requirements.* The final rule adds spirometry testing, occupational history, and symptom assessment to the periodic chest radiographic (x-ray) examinations required to be offered by mine operators to underground miners under NIOSH's existing standards. The additional medical surveillance requirements will alert miners to any abnormal declines in lung function, which is common evidence of Chronic Obstructive Pulmonary Disease (COPD) and not detected by chest x-rays. Notification of reduced lung function will enable miners to be proactive in protecting their health. The final rule extends the same medical surveillance requirements afforded underground miners, including chest x-ray examinations, to surface miners since they are also at risk of developing lung diseases and material impairment of health or functional capacity from exposure to respirable coal mine dust. In addition, the final rule extends part 90 miner transfer rights, which are currently provided to underground miners who have x-ray evidence of pneumoconiosis, to surface miners who have evidence of pneumoconiosis.
- *Strengthens Requirements for Certified Persons.* The final rule revises requirements for certified persons who perform dust sampling and who maintain and calibrate sampling equipment. To strengthen the certification process, the final rule adds a requirement that persons must complete an MSHA course of instruction.

MINING SECTORS COVERED BY THE FINAL RULE

The final rule applies to all underground and surface coal mines in the United States. The average number of active underground coal mines for the 12 months ending January 2010 was 424. These mines employed approximately 47,000 miners and contractors (excluding office workers). The average number of active surface coal mines for the 12 months ending January 2010 was 1,123. These mines employed approximately 56,000 miners and contractors (excluding office workers). MSHA examined the industry data for the years 2011 and 2012 and concluded that there were a number of changes, both up and down. The number of mines decreased, the number of mechanized mining units (MMUs) decreased slightly, and employment increased. MSHA concluded updating the industry data would not have a significant impact on the analysis.

NET BENEFITS

Under the Federal Mine Safety and Health Act of 1977 (Mine Act), the Secretary of Labor is required to set standards which most adequately assure on the basis of the best available evidence that no miner will suffer material impairment of health or functional capacity even if such miner has regular exposure to the hazards dealt with by such standard for the period of his working life. Congress realized that there "is an urgent need to provide more effective means and measures for improving the working conditions and practices in the Nation's coal or other mines in order to prevent death and serious physical harm, and in order to prevent occupational diseases originating in such mines." 30 U.S.C. 801(c). The Senate Committee on Human

Resources emphasized, “that it rejects the view that cost benefit ratios alone may be the basis for depriving miners of the health protection which the law intended to insure.” S. Rep. No. 95-181, 95th Cong. 1st Sess. 21 (1977).

To compare the estimate of benefits with the estimate of costs, it is necessary to project the timing of the benefits and costs. An analytical period of 65 years was necessary to capture the full impact of preventing premature mortality and disease. The 65-year analytical period accounts for the assumed 45-year working life plus an average lag of 20 years to account for the turnover of the workforce and sufficient time for morbidity and mortality to occur.

MSHA estimates the final rule will produce a positive net benefit, with annualized net benefits of \$12.1 million (\$36.9 million benefits minus \$24.8 million costs) at a discount rate of 3 percent, and a negative net benefit of -\$8.1 million (\$20.0 million benefits minus \$28.1 million costs) at a 7 percent discount rate. In addition to the quantified benefits, MSHA believes there are qualitative benefits that are described in both this economic analysis and the preamble of the final rule.

COST SUMMARY

MSHA estimates that the first year costs of the final rule to coal mine operators will be \$61 million and the annualized costs of the final rule will be \$30.2 million, with a 7 percent discount rate. When costs to the government are added, first year costs of the final rule are \$61.4 million and annualized costs of the final rule are \$30.6 million, with a 7 percent discount rate. These costs do not include penalties from additional citations that MSHA estimates will be issued under the final rule. Penalties are not considered costs of the rule. Rather, they are considered to be transfer payments to the government resulting from violations of the final rule. Penalties are reported separately below.

MSHA estimates that the first year costs of the final rule for underground coal mine operators will be \$52.7 million. Costs associated with the final requirement to use CPDMs (\$34.1 million) and upgrading and maintaining engineering controls and work practices (\$10.7 million) represent the most significant estimated first year costs for underground coal mine operators. The first year costs of the final rule for surface coal mine operators will be \$8.3 million. The extension of the part 90 option to surface coal miners (\$3.9 million) represents the most significant estimated first year cost for surface coal mine operators.

MSHA estimates that at a 7 percent discount rate, the annualized costs of the final rule for underground coal mine operators will be \$26.2 million. Costs associated with the final requirement to use CPDMs (\$14.6 million) and upgrading and maintaining engineering controls and work practices (\$5.1 million) represent the most significant annualized costs for underground coal mine operators. MSHA estimates that at a 7 percent discount rate, the annualized costs of the final rule for surface coal mine operators will be \$4.0 million. Costs associated with using the gravimetric sampler (which is also called the Coal Mine Dust Personal Sampling Unit, CMDPSU) for expanding sampling to all surface coal mines (\$1.1 million) represent the most significant annualized cost for surface coal mine operators.

MSHA estimates that operators will incur additional annual penalties of \$889,200 (of which \$864,300 is associated with underground coal mine operators and \$24,900 is associated with surface coal mine operators) from additional citations expected under the final rule.

For a detailed discussion of MSHA's cost estimates for the final rule, see Chapter IV of this REA.

ECONOMIC FEASIBILITY

MSHA has traditionally used a revenue screening test -- whether the annualized compliance costs of a final rule are less than 1 percent of annual revenues, or are negative (i.e., provide net cost savings) -- to establish that compliance with a rule is economically feasible for the coal mining industry. Underground coal mine operators' annualized cost is 0.13 percent of their annual revenues. Surface coal mine operators' annualized cost is 0.02 percent of their annual revenues. MSHA has concluded that the requirements of the final rule are economically feasible since MSHA estimates that compliance costs for both underground and surface coal mines are below one percent of estimated annual revenues. Additionally, recent Census Bureau data shows mining in general with operating profits greater than 17 percent of sales and corresponding after tax profits of approximately 10 percent.¹ The Agency believes that with these average profit levels, when the cost of a regulation has less than a 1 percent impact on the affected industry's revenues it is generally appropriate to conclude that the regulation is feasible.

BENEFITS

The final rule significantly improves health protections for coal miners by reducing their occupational exposure to respirable coal mine dust and lowering the risk that they will suffer material impairment of health or functional capacity over their working lives and after retirement. MSHA quantified the benefits from three major provisions of the final rule: lowering the limit from 2.0 mg/m³ to 1.5 mg/m³, basing determinations of noncompliance on MSHA inspector single samples, and revising the definition of normal production shift.

MSHA's Quantitative Risk Assessment (QRA) for the final rule estimates the risk for miners occupationally-exposed to respirable coal mine dust for a total of 86,400 hours over a 45-year occupational lifetime. The QRA considered two provisions of the final rule (1) using MSHA inspector single samples rather than the average of 5 samples to determine compliance and (2) lowering the limit from 2.0 mg/m³ to 1.5 mg/m³. The number of adverse health events prevented considered miners who were occupationally exposed to respirable coal mine dust for 45 years at age 73 years of age. Overall, 593 cases of coal workers' pneumoconiosis (CWP 1+); 473 cases of CWP 2+; 319 cases of progressive massive fibrosis (PMF); 248 cases of severe emphysema; and 26 deaths from non-malignant respiratory disease (NMRD) will be prevented.

The Agency projects there will be additional quantifiable reductions in illness and death from revising the definition of normal production shift. MSHA estimates that the total number of cases prevented by all three provisions will be: 869 cases of CWP 1+; 655 cases of CWP 2+; 433 cases of PMF; 374 cases of severe emphysema; and 65 deaths from NMRD.

Over the 65-year analytical period, the requirements of the rule will result in benefits of \$3.4 billion, discounted at a 0 percent rate, \$1.1 billion, discounted at a 3 percent rate; or \$0.3 billion discounted at a 7 percent rate. See Chapter V of this REA for a detailed explanation of the benefits of the final rule including a range of values.

¹ Most recent Census Bureau data can be found at <http://www2.census.gov/econ/qfr/current/mmwl.xls> on the line for Mining.

EXECUTIVE ORDER 12866 AND 13563: REGULATORY PLANNING AND REVIEW

Executive Orders (E.O.) 12866 and 13563 direct agencies to assess all costs and benefits of available regulatory alternatives, and, if regulation is necessary, to select regulatory approaches that maximize net benefits (including potential economic, environmental, public health and safety effects, distributive impacts, and equity). Executive Order 13563 emphasizes the importance of quantifying both costs and benefits, reducing costs, harmonizing rules, and promoting flexibility. MSHA analysis as required under these Executive Orders is presented in this Regulatory Economic Analysis.

In addition, under E.O. 12866, MSHA must determine whether a regulatory action is “significant” and subject to review by the Office of Management and Budget (OMB). The final rule may have an effect of \$100 million or more on the economy in at least one year, and is therefore an “economically significant” regulatory action in accordance with § 3(f) of E.O. 12866 and is subject to OMB review.

The Regulatory Flexibility Act (RFA) of 1980, as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA), requires regulatory agencies to consider a rule’s economic impact on small entities. For the mining industry, SBA defines a small mine as one with 1-500 employees and a large mine as one with more than 500 employees. Based on MSHA’s analysis, the Agency notified the Chief Counsel for Advocacy, SBA, and made the certification under the Regulatory Flexibility Act at U.S.C. 605(b) that the final rule does not have a significant economic impact on a substantial number of small entities. The analysis that provides the factual basis for this certification is discussed in Chapter VI of this REA and in the preamble to the final rule published in the *Federal Register*.

II. INDUSTRY PROFILE

INTRODUCTION

This chapter provides information on the structure and economic characteristics of the coal mining industry, including the number and type of mines by mine size. The source of these data is the U.S. Department of Labor, MSHA's Office of Program Evaluation and Information Resources (PEIR). Data on number of mines by employment size, the number of mechanized mining units (MMUs), and employment are not changed from data used for the proposed rule. However, coal price and production data used to derive coal revenues have been updated in this Chapter.

STRUCTURE OF THE MINING INDUSTRY

MSHA divides the mining industry into two major sectors based on commodity: (1) coal mines and (2) metal and nonmetal mines. Each sector is further divided by type of operation (e.g., underground coal mines or surface coal mines). The Agency maintains data on the number of mines by mine type and mine size. MSHA also collects data on the number of independent contractor firms and their employees. Each independent contractor is issued one MSHA contractor identification number but may work at any mine.

STRUCTURE OF THE UNDERGROUND COAL MINING INDUSTRY

The average number of active underground coal mines for 12 months ending January 2010 was 424. These mines employed 47,004 miners and contractors, excluding office workers. In 2010, there were 232 underground coal mine independent contractors with 6,685 employees, excluding office workers. Table II-1 presents the 12-month average of the number of underground coal mines, miners and independent contractors (excluding office employees), by employment size.

**Table II-1: Underground Coal Mines, Miners, and Independent Contractors
(Excluding Office Employees), 12-Month Average,
By Mine Size**

Size of Mine	Underground Coal Mines	Employment at Underground Coal Mines, Excluding Office Employees
1-19 Employees	81	1,179
20-500 Employees	331	29,432
501+ Employees	12	9,708
Contractors	--	6,685
Total	424	47,004

There was an average of 881 active mechanized mining units (MMUs) in underground coal mines during the 12 months ending January 2010. An MMU is a unit of mining equipment used for the production of material. Table II-2 presents the number of MMUs by mine type and mine size.

**Table II-2: Average Number of Non-Longwall and Longwall MMUs
in Underground Coal Mines, 12-Month Average,
By Mine Size**

Size of Mine	Non-Longwall MMUs	Longwall MMUs	Total
1-19 Employees	81	0	81
20-500 Employees	686	22	708
501+ Employees	72	20	92
Total	839	42	881

STRUCTURE OF THE SURFACE COAL MINING INDUSTRY

The average number of active surface coal mines (including most surface facilities) for the 12 months ending January 2010, was 1,123. These mines employed 56,067 employees (excluding office workers). As of May 2010, there were 2,431 surface coal mine contractor firms. These 2,431 firms had 23,817 employees (excluding office workers). Table II-3 presents the 12-month average of the number of surface coal mines (including facilities), miners and independent contractors (excluding office employees), by size of mine.

**Table II-3: Surface Coal Mines (Including Facilities), Miners
and Independent Contractors (Excluding Office Employees),
12-Month Average, By Mine Size**

Size of Mine	Surface Coal Mines	Employment at Surface Coal Mines, Excluding Office Employees
1-19 Employees	620	4,837
20-500 Employees	499	23,881
501+ Employees	4	3,532
Contractors	--	23,817
Total	1,123	56,067

ECONOMIC CHARACTERISTICS OF THE COAL MINING INDUSTRY

MSHA classifies the U.S. coal mining sector into three major commodity groups: bituminous, lignite, and anthracite.² Bituminous operations represent approximately 97 percent of coal mining operations and approximately 99 percent of coal miners and total coal production. Anthracite operations represent approximately 2 percent of coal mining operations and less than 1 percent of coal miners and total coal production. Lignite operations represent less than 1 percent of coal mining operations, coal miners, and total coal production.

² This categorization is based on MSHA-collected data grouped by Standard Industrial Classification (SIC) code description. Some publications of the U.S. Department of Energy further divide the bituminous group into bituminous coal and sub-bituminous coal.

In 2010, the U.S. coal sector produced approximately 1.1 billion tons of coal, of which 748.7 million tons was from surface coal mines and 337.3 million tons was from underground coal mines. The 2010 average open market U.S. sales price of coal was \$60.73 per ton for underground coal mines and \$24.13 per ton for surface coal mines. The price per ton for underground and surface coal is from the Department of Energy (DOE), Energy Information Administration (EIA), *Annual Coal Report 2010*, DOE/EIA-0584(2010), Table 28. Table II-4 presents the coal production and revenues for 2010. However, in later chapters of this analysis, MSHA has retained the 2009 production data presented in the PREA to be consistent with the estimates in the Quantitative Risk Assessment.

Table II-4: Coal Production in Tons and Coal Revenues in 2010

Coal Production in Tons			
Mine Size	Coal-Surface	Coal-UG	Total
1-19 Employees	17,431,783	3,687,255	21,119,038
20-500 Employees	434,882,167	247,441,842	682,324,009
500+ Employees	296,389,246	86,219,427	382,608,673
Grand Total	748,703,196	337,348,524	1,086,051,720
Total Coal Revenues, Apportioned by Coal Tonnage Produced			
Mine Size	Coal-Surface	Coal-UG	Total
1-19 Employees	\$420,628,924	\$223,926,996	\$644,555,920
20-500 Employees	\$10,493,706,690	\$15,027,143,065	\$25,520,849,754
500+ Employees	\$7,151,872,506	\$5,236,105,802	\$12,387,978,308
Grand Total	\$18,066,208,119	\$20,487,175,863	\$38,553,383,982

III. SUMMARY OF COST AND BENEFIT ESTIMATES

INTRODUCTION

This section presents a summary of MSHA's estimates of the costs and benefits of the final rule. Under the Mine Act, MSHA is not required to use the estimated net benefits as the basis for its regulatory decisions.

The net benefit estimates are based on the estimates presented in cost and benefit chapters. Details on the cost and benefit estimates are found in Chapter IV and Chapter V. To compare the cost and benefit estimates, it is necessary to project the timing of the diseases that will be avoided. An analytical period of 65 years captures the full impact of preventing premature mortality and disease. Based on the analysis presented below and summarized in Table III-4, MSHA estimates that the annualized value of the net benefits over a 65-year period is \$33.2 million undiscounted (i.e., a 0 percent discount rate), \$12.1 million at a 3 percent discount rate, and -\$8.1 million at a 7 percent discount rate.

ESTIMATE OF THE COST OF THE FINAL RULE

Table III-1 presents estimates of the annualized costs associated with compliance with the requirements of the final rule consistent with the cost chapter (Chapter 4). The costs in Table III-1 are presented by mine size: 1-19 employees, 20-500 employees, and 501+ employees. The components of the annualized cost estimate of \$30.6 million (total for the government, underground, and surface coal mine operators) in Table III 1 are repeated with additional description in Table IV 2 and the supporting text. The year-by-year costs in Table III-3 are consistent with MSHA's traditional cost methodology, presentation, and Chapter IV, the cost chapter, which annualizes the costs so that the estimates costs are constant in each year. Year-by- year costs in Tables III-4 and III-5 reflect MSHA's actual projections of the timing of costs. The summary tables III-3, III-4, and III-5 each have differences in the time periods and method of distributing the costs. Therefore, these tables present alternate views of timing and discounting of the same underlying cost and benefit numbers.

Table III-1: Annualized Costs of Final Rule at a 7 Percent Discount Rate

Requirements	1-19	20-500	501+	Totals
Underground Operators				
Engineering Controls	\$133,300	\$4,496,800	\$448,500	\$5,078,600
Mine Ventilation Plan Changes	\$1,200	\$5,100	\$200	\$6,500
Abatement Costs	\$21,600	\$170,600	\$33,700	\$225,900
Costs Incurred When Samples Meet or Exceed the ECV	\$71,500	\$662,700	\$91,000	\$825,200
Certification to Sample & Maintain	\$41,600	\$483,800	\$50,300	\$575,700
Record of Production	\$103,000	\$2,247,600	\$0	\$2,350,600
Record of Shift Length	\$1,600	\$17,400	\$12,500	\$31,500
Using Gravimetric Sampler	-\$106,400	-\$1,122,900	-\$119,900	-\$1,349,200
Using CPDMs	\$1,063,300	\$12,325,600	\$1,220,000	\$14,608,900
On Shift Exams	\$114,400	\$3,000,400	\$454,900	\$3,569,700
Periodic Examinations	\$8,600	\$127,200	\$37,800	\$173,500
Respiratory Equipment Training	\$6,400	\$111,800	\$14,500	\$132,700
Underground Total	\$1,460,100	\$22,526,100	\$2,243,500	\$26,229,600
Surface Operators				
Engineering Controls	\$48,900	\$185,500	\$102,100	\$336,500
Abatement Costs	\$8,600	\$7,100	\$1,400	\$17,100
Certify to Sample & Maintain	\$107,100	\$115,000	\$2,000	\$224,000
Record of Shift Length	\$144,500	\$551,000	\$23,400	\$718,800
Using Gravimetric Sampler	\$384,300	\$658,400	\$21,600	\$1,064,300
Periodic Examinations	\$139,000	\$370,800	\$50,200	\$559,900
Respiratory Training	\$700	\$600	\$100	\$1,400
Extension of Part 90 Option to Surface Mines	\$160,100	\$789,600	\$116,400	\$1,066,100
Surface Total	\$993,200	\$2,678,000	\$317,200	\$3,988,100
ALL				
UG. & Surf. Total	\$2,453,300	\$25,204,100	\$2,560,700	\$30,217,700
Costs to Government				\$395,800
UG. & Surf. With Gov. Costs				\$30,613,500

SUMMARY OF MONETIZED BENEFITS

As is discussed in Chapter V, MSHA made several changes in the calculation of the monetized benefits from the methodology used in the Preliminary Regulatory Economic Analysis (PREA). In the PREA, MSHA calculated the benefits based on 2 provisions analyzed in the QRA for the proposed rule (lowering the limit from 2.0 mg/m³ to 1.0 mg/m³ and basing determinations of noncompliance on MSHA inspector single samples rather than the average of 5 samples) and two additional provisions of the proposed rule (including the definition of normal production shift). The results in the PREA were based on the proposed equivalent concentration definition which included an adjustment to the measured respirable coal mine dust samples to account for shifts longer than 8 hours. Furthermore, MSHA monetized the benefits associated with risk reductions due to lowering the respirable dust standard to 1.0 mg/m³ and projected that all of the benefits would occur during a miner's 45-year working lifetime.

In the REA, MSHA has updated some of the per case values and calculated the benefits based on 3 provisions (basing compliance on a single MSHA inspector sample, lowering the respirable dust standard to 1.5 mg/m³, and revised definition of normal production shift). Benefits are not calculated on applying an 8-hour conversion to shifts longer than 8 hours since, after consideration of the comments and relevant data, MSHA is no longer requiring an equivalent 8-hour concentration formula to be applied to shifts longer than 8 hours. Therefore, the reductions in adverse health effects associated with those adjustments are no longer assumed. In addition, MSHA monetized the benefits associated with risk reductions due to lowering the respirable dust standard to 1.5 mg/m³ and incorporated a lag of 20 years to account for employee turnover and the time it takes for the adverse health outcomes to appear. In MSHA's final analysis, the benefits are not fully realized until 65 years (45-year working lifetime plus 20 year lag) after the final rule goes into effect.

Table III-2 shows a summary of the benefits, present value and annualized.

TABLE III-2: Summary of Benefits

Discount Rate	Benefit Present Value (Billions of Dollars)	Annualized Benefits (Millions of Dollars)
7 Percent	\$0.3	\$20.0
3 Percent	\$1.1	\$36.9
Undiscounted	\$3.4	\$52.9
* Table V-10 includes ranges with additional values		

CALCULATING NET BENEFITS

An appropriate discount rate is needed to reflect the timing of net benefits over the 65-year period after the final rule takes effect and to allow conversion to an equivalent steady stream of annualized net benefits. Following OMB guidelines, MSHA estimates the annualized benefits of the final rule using separate discount rates of 3 percent and 7 percent. MSHA has also estimated undiscounted benefits (0 percent discount rate). One method for estimating the social rate of time preference is to calculate the post-tax real rate of return on long-term, risk-free assets, such as U.S. Treasury securities.³ The average interest rate on long-term US Treasuries for 2013 was approximately 3.1 percent.⁴

As discussed in Chapter V, the estimate of the stream of benefits arising from the final rule is not constant from year to year. Similarly, costs vary from year-to-year due to the need to replace equipment that reaches the end of its useful life. For each year of the 65-year period, MSHA compared the benefit estimate to the annualized cost estimate of \$30.6 million presented in Table III-1. Table III-3 shows the year-by-year benefits, costs, and net benefits according to presentational approach that is consistent with section IV of this document and with the economic analysis of the proposed rule. As an alternative presentation, in accordance with OMB

³ U. S. Office of Management and Budget, 2003. Circular A-4, Regulatory Analysis, September 17, 2003. Available at: http://www.whitehouse.gov/sites/default/files/omb/assets/regulatory_matters_pdf/a-4.pdf.

⁴ See the U.S. Treasury website at <http://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/TextView.aspx?data=longtermrateYear&year=2013>.

Circular A-4, Table III-4 shows cost estimates by year without amortization. This method provides matching year-by-year comparisons. . The annualized costs and benefits presented in Tables III-3 and III-4 are based upon a 65 year discount period. Table III-5 shows the Table III-4 values but with a 45-year discount period.

**Table III-3: Streams of Benefits, Costs, and Net Benefits, by Year and by 65-Year Total
Based upon Varying Annual Benefits and Constant Yearly Costs, Annualized over 65 Years**

	No Discount			3 Percent Discount Rate				7 Percent Discount Rate			
Year	Benefits (\$ Millions)	Costs (\$ Millions)	Net Benefit (\$ Millions)	Discount Factor	Discounted Benefits (\$ Millions)	Discounted Costs (\$ Millions)	Discounted Net Benefit (\$ Millions)	Discount Factor	Discounted Benefits (\$ Millions)	Discounted Costs (\$ Millions)	Discounted Net Benefits (\$ Millions)
1	\$0.0	\$30.6	-\$30.6	0.9709	\$0.0	\$29.7	-\$29.7	0.9346	\$0.0	\$28.6	-\$28.6
2	\$0.0	\$30.6	-\$30.6	0.9426	\$0.0	\$28.9	-\$28.9	0.8734	\$0.0	\$26.7	-\$26.7
3	\$0.0	\$30.6	-\$30.6	0.9151	\$0.0	\$28.0	-\$28.0	0.8163	\$0.0	\$25.0	-\$25.0
4	\$0.0	\$30.6	-\$30.6	0.8885	\$0.0	\$27.2	-\$27.2	0.7629	\$0.0	\$23.4	-\$23.4
5	\$0.0	\$30.6	-\$30.6	0.8626	\$0.0	\$26.4	-\$26.4	0.7130	\$0.0	\$21.8	-\$21.8
6	\$0.0	\$30.6	-\$30.6	0.8375	\$0.0	\$25.6	-\$25.6	0.6663	\$0.0	\$20.4	-\$20.4
7	\$0.0	\$30.6	-\$30.6	0.8131	\$0.0	\$24.9	-\$24.9	0.6227	\$0.0	\$19.1	-\$19.1
8	\$0.1	\$30.6	-\$30.6	0.7894	\$0.0	\$24.2	-\$24.1	0.5820	\$0.0	\$17.8	-\$17.8
9	\$0.2	\$30.6	-\$30.5	0.7664	\$0.1	\$23.5	-\$23.3	0.5439	\$0.1	\$16.7	-\$16.6
10	\$0.4	\$30.6	-\$30.2	0.7441	\$0.3	\$22.8	-\$22.5	0.5083	\$0.2	\$15.6	-\$15.4
11	\$0.8	\$30.6	-\$29.8	0.7224	\$0.6	\$22.1	-\$21.5	0.4751	\$0.4	\$14.5	-\$14.2
12	\$1.6	\$30.6	-\$29.0	0.7014	\$1.1	\$21.5	-\$20.3	0.4440	\$0.7	\$13.6	-\$12.9
13	\$3.0	\$30.6	-\$27.6	0.6810	\$2.0	\$20.8	-\$18.8	0.4150	\$1.2	\$12.7	-\$11.5
14	\$5.1	\$30.6	-\$25.6	0.6611	\$3.3	\$20.2	-\$16.9	0.3878	\$2.0	\$11.9	-\$9.9
15	\$8.0	\$30.6	-\$22.6	0.6419	\$5.1	\$19.6	-\$14.5	0.3624	\$2.9	\$11.1	-\$8.2
16	\$12.0	\$30.6	-\$18.6	0.6232	\$7.5	\$19.1	-\$11.6	0.3387	\$4.1	\$10.4	-\$6.3
17	\$16.9	\$30.6	-\$13.7	0.6050	\$10.2	\$18.5	-\$8.3	0.3166	\$5.4	\$9.7	-\$4.3
18	\$22.7	\$30.6	-\$7.9	0.5874	\$13.3	\$18.0	-\$4.6	0.2959	\$6.7	\$9.1	-\$2.3
19	\$29.2	\$30.6	-\$1.5	0.5703	\$16.6	\$17.5	-\$0.8	0.2765	\$8.1	\$8.5	-\$0.4
20	\$36.0	\$30.6	\$5.3	0.5537	\$19.9	\$16.9	\$3.0	0.2584	\$9.3	\$7.9	\$1.4
21	\$42.7	\$30.6	\$12.1	0.5375	\$23.0	\$16.5	\$6.5	0.2415	\$10.3	\$7.4	\$2.9
22	\$49.2	\$30.6	\$18.6	0.5219	\$25.7	\$16.0	\$9.7	0.2257	\$11.1	\$6.9	\$4.2
23	\$55.1	\$30.6	\$24.5	0.5067	\$27.9	\$15.5	\$12.4	0.2109	\$11.6	\$6.5	\$5.2
24	\$60.2	\$30.6	\$29.6	0.4919	\$29.6	\$15.1	\$14.6	0.1971	\$11.9	\$6.0	\$5.8
25	\$64.5	\$30.6	\$33.9	0.4776	\$30.8	\$14.6	\$16.2	0.1842	\$11.9	\$5.6	\$6.2
26	\$67.9	\$30.6	\$37.3	0.4637	\$31.5	\$14.2	\$17.3	0.1722	\$11.7	\$5.3	\$6.4

**Table III-3: Streams of Benefits, Costs, and Net Benefits, by Year and by 65-Year Total
Based upon Varying Annual Benefits and Constant Yearly Costs, Annualized over 65 Years**

	No Discount			3 Percent Discount Rate				7 Percent Discount Rate			
Year	Benefits (\$ Millions)	Costs (\$ Millions)	Net Benefit (\$ Millions)	Discount Factor	Discounted Benefits (\$ Millions)	Discounted Costs (\$ Millions)	Discounted Net Benefit (\$ Millions)	Discount Factor	Discounted Benefits (\$ Millions)	Discounted Costs (\$ Millions)	Discounted Net Benefits (\$ Millions)
27	\$70.5	\$30.6	\$39.9	0.4502	\$31.7	\$13.8	\$18.0	0.1609	\$11.3	\$4.9	\$6.4
28	\$72.4	\$30.6	\$41.8	0.4371	\$31.7	\$13.4	\$18.3	0.1504	\$10.9	\$4.6	\$6.3
29	\$73.8	\$30.6	\$43.2	0.4243	\$31.3	\$13.0	\$18.3	0.1406	\$10.4	\$4.3	\$6.1
30	\$74.8	\$30.6	\$44.2	0.4120	\$30.8	\$12.6	\$18.2	0.1314	\$9.8	\$4.0	\$5.8
31	\$75.4	\$30.6	\$44.8	0.4000	\$30.2	\$12.2	\$17.9	0.1228	\$9.3	\$3.8	\$5.5
32	\$75.8	\$30.6	\$45.2	0.3883	\$29.5	\$11.9	\$17.6	0.1147	\$8.7	\$3.5	\$5.2
33	\$76.1	\$30.6	\$45.5	0.3770	\$28.7	\$11.5	\$17.1	0.1072	\$8.2	\$3.3	\$4.9
34	\$76.3	\$30.6	\$45.6	0.3660	\$27.9	\$11.2	\$16.7	0.1002	\$7.6	\$3.1	\$4.6
35	\$76.3	\$30.6	\$45.7	0.3554	\$27.1	\$10.9	\$16.3	0.0937	\$7.2	\$2.9	\$4.3
36	\$76.4	\$30.6	\$45.8	0.3450	\$26.4	\$10.6	\$15.8	0.0875	\$6.7	\$2.7	\$4.0
37	\$76.4	\$30.6	\$45.8	0.3350	\$25.6	\$10.3	\$15.3	0.0818	\$6.3	\$2.5	\$3.7
38	\$76.4	\$30.6	\$45.8	0.3252	\$24.9	\$10.0	\$14.9	0.0765	\$5.8	\$2.3	\$3.5
39	\$76.4	\$30.6	\$45.8	0.3158	\$24.1	\$9.7	\$14.5	0.0715	\$5.5	\$2.2	\$3.3
40	\$76.5	\$30.6	\$45.8	0.3066	\$23.4	\$9.4	\$14.1	0.0668	\$5.1	\$2.0	\$3.1
41	\$76.5	\$30.6	\$45.8	0.2976	\$22.8	\$9.1	\$13.6	0.0624	\$4.8	\$1.9	\$2.9
42	\$76.5	\$30.6	\$45.8	0.2890	\$22.1	\$8.8	\$13.2	0.0583	\$4.5	\$1.8	\$2.7
43	\$76.5	\$30.6	\$45.8	0.2805	\$21.4	\$8.6	\$12.9	0.0545	\$4.2	\$1.7	\$2.5
44	\$76.5	\$30.6	\$45.8	0.2724	\$20.8	\$8.3	\$12.5	0.0509	\$3.9	\$1.6	\$2.3
45	\$76.5	\$30.6	\$45.8	0.2644	\$20.2	\$8.1	\$12.1	0.0476	\$3.6	\$1.5	\$2.2
46	\$76.5		\$76.5	0.2567	\$19.6		\$19.6	0.0445	\$3.4		\$3.4
47	\$76.5		\$76.5	0.2493	\$19.1		\$19.1	0.0416	\$3.2		\$3.2
48	\$76.5		\$76.5	0.2420	\$18.5		\$18.5	0.0389	\$3.0		\$3.0
49	\$76.5		\$76.5	0.2350	\$18.0		\$18.0	0.0363	\$2.8		\$2.8
50	\$76.5		\$76.5	0.2281	\$17.4		\$17.4	0.0339	\$2.6		\$2.6
51	\$76.5		\$76.5	0.2215	\$16.9		\$16.9	0.0317	\$2.4		\$2.4
52	\$76.5		\$76.5	0.2150	\$16.4		\$16.4	0.0297	\$2.3		\$2.3
53	\$76.5		\$76.5	0.2088	\$16.0		\$16.0	0.0277	\$2.1		\$2.1
54	\$76.5		\$76.5	0.2027	\$15.5		\$15.5	0.0259	\$2.0		\$2.0
55	\$76.5		\$76.5	0.1968	\$15.0		\$15.0	0.0242	\$1.9		\$1.9

**Table III-3: Streams of Benefits, Costs, and Net Benefits, by Year and by 65-Year Total
Based upon Varying Annual Benefits and Constant Yearly Costs, Annualized over 65 Years**

	No Discount			3 Percent Discount Rate				7 Percent Discount Rate			
Year	Benefits (\$ Millions)	Costs (\$ Millions)	Net Benefit (\$ Millions)	Discount Factor	Discounted Benefits (\$ Millions)	Discounted Costs (\$ Millions)	Discounted Net Benefit (\$ Millions)	Discount Factor	Discounted Benefits (\$ Millions)	Discounted Costs (\$ Millions)	Discounted Net Benefits (\$ Millions)
56	\$76.5		\$76.5	0.1910	\$14.6		\$14.6	0.0226	\$1.7		\$1.7
57	\$76.5		\$76.5	0.1855	\$14.2		\$14.2	0.0211	\$1.6		\$1.6
58	\$76.5		\$76.5	0.1801	\$13.8		\$13.8	0.0198	\$1.5		\$1.5
59	\$76.5		\$76.5	0.1748	\$13.4		\$13.4	0.0185	\$1.4		\$1.4
60	\$76.5		\$76.5	0.1697	\$13.0		\$13.0	0.0173	\$1.3		\$1.3
61	\$76.5		\$76.5	0.1648	\$12.6		\$12.6	0.0161	\$1.2		\$1.2
62	\$76.5		\$76.5	0.1600	\$12.2		\$12.2	0.0151	\$1.2		\$1.2
63	\$76.5		\$76.5	0.1553	\$11.9		\$11.9	0.0141	\$1.1		\$1.1
64	\$76.5		\$76.5	0.1508	\$11.5		\$11.5	0.0132	\$1.0		\$1.0
65	\$76.5		\$76.5	0.1464	\$11.2		\$11.2	0.0123	\$0.9		\$0.9
Total	\$3,440.6	\$1,377.6	\$2,063.0		\$1,050.2	\$750.6	\$299.6		\$281.7	\$416.5	-\$134.8

Annualized Values (65 Years, \$ millions)

	\$52.9	\$21.2	\$31.7		\$36.9	\$26.4	\$10.5		\$20.0	\$29.5	-\$9.6
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**Table III-4: Streams of Benefits, Costs, and Net Benefits, by Year and by 65-Year Total
Based upon Varying Annual Benefits and Costs, Annualized over 65 Years**

	No Discount			3 Percent Discount Rate				7 Percent Discount Rate			
Year	Benefits (\$ Millions)	Costs (\$ Millions)	Net Benefit (\$ Millions)	Discount Factor	Discounted Benefits (\$ Millions)	Discounted Costs (\$ Millions)	Discounted Net Benefit (\$ Millions)	Discount Factor	Discounted Benefits (\$ Millions)	Discounted Costs (\$ Millions)	Discounted Net Benefit (\$ Millions)
1	\$0.0	\$39.6	-\$39.6	0.9709	\$0.0	\$38.4	-\$38.4	0.9346	\$0.0	\$37.0	-\$37.0
2	\$0.0	\$35.2	-\$35.2	0.9426	\$0.0	\$33.2	-\$33.2	0.8734	\$0.0	\$30.8	-\$30.8
3	\$0.0	\$21.9	-\$21.9	0.9151	\$0.0	\$20.0	-\$20.0	0.8163	\$0.0	\$17.8	-\$17.8
4	\$0.0	\$21.2	-\$21.2	0.8885	\$0.0	\$18.8	-\$18.8	0.7629	\$0.0	\$16.2	-\$16.2
5	\$0.0	\$21.0	-\$21.0	0.8626	\$0.0	\$18.1	-\$18.1	0.7130	\$0.0	\$15.0	-\$15.0
6	\$0.0	\$42.5	-\$42.5	0.8375	\$0.0	\$35.6	-\$35.6	0.6663	\$0.0	\$28.3	-\$28.3
7	\$0.0	\$37.4	-\$37.4	0.8131	\$0.0	\$30.4	-\$30.4	0.6227	\$0.0	\$23.3	-\$23.3
8	\$0.1	\$21.0	-\$21.0	0.7894	\$0.0	\$16.6	-\$16.6	0.5820	\$0.0	\$12.2	-\$12.2
9	\$0.2	\$21.0	-\$20.9	0.7664	\$0.1	\$16.1	-\$16.0	0.5439	\$0.1	\$11.4	-\$11.4
10	\$0.4	\$21.0	-\$20.6	0.7441	\$0.3	\$15.6	-\$15.4	0.5083	\$0.2	\$10.7	-\$10.5
11	\$0.8	\$42.6	-\$41.8	0.7224	\$0.6	\$30.8	-\$30.2	0.4751	\$0.4	\$20.3	-\$19.9
12	\$1.6	\$37.4	-\$35.8	0.7014	\$1.1	\$26.3	-\$25.1	0.4440	\$0.7	\$16.6	-\$15.9
13	\$3.0	\$21.0	-\$18.0	0.6810	\$2.0	\$14.3	-\$12.3	0.4150	\$1.2	\$8.7	-\$7.5
14	\$5.1	\$21.0	-\$16.0	0.6611	\$3.3	\$13.9	-\$10.6	0.3878	\$2.0	\$8.2	-\$6.2
15	\$8.0	\$21.0	-\$13.0	0.6419	\$5.1	\$13.5	-\$8.4	0.3624	\$2.9	\$7.6	-\$4.7
16	\$12.0	\$42.5	-\$30.5	0.6232	\$7.5	\$26.5	-\$19.0	0.3387	\$4.1	\$14.4	-\$10.3
17	\$16.9	\$37.4	-\$20.5	0.6050	\$10.2	\$22.6	-\$12.4	0.3166	\$5.4	\$11.9	-\$6.5
18	\$22.7	\$21.0	\$1.7	0.5874	\$13.3	\$12.4	\$1.0	0.2959	\$6.7	\$6.2	\$0.5
19	\$29.2	\$21.0	\$8.1	0.5703	\$16.6	\$12.0	\$4.6	0.2765	\$8.1	\$5.8	\$2.2
20	\$36.0	\$21.0	\$14.9	0.5537	\$19.9	\$11.6	\$8.3	0.2584	\$9.3	\$5.4	\$3.9
21	\$42.7	\$41.8	\$1.0	0.5375	\$23.0	\$22.5	\$0.5	0.2415	\$10.3	\$10.1	\$0.2
22	\$49.2	\$38.3	\$10.9	0.5219	\$25.7	\$20.0	\$5.7	0.2257	\$11.1	\$8.6	\$2.5
23	\$55.1	\$21.0	\$34.1	0.5067	\$27.9	\$10.7	\$17.3	0.2109	\$11.6	\$4.4	\$7.2
24	\$60.2	\$21.0	\$39.2	0.4919	\$29.6	\$10.3	\$19.3	0.1971	\$11.9	\$4.1	\$7.7
25	\$64.5	\$21.0	\$43.4	0.4776	\$30.8	\$10.0	\$20.7	0.1842	\$11.9	\$3.9	\$8.0
26	\$67.9	\$42.5	\$25.4	0.4637	\$31.5	\$19.7	\$11.8	0.1722	\$11.7	\$7.3	\$4.4
27	\$70.5	\$37.4	\$33.1	0.4502	\$31.7	\$16.9	\$14.9	0.1609	\$11.3	\$6.0	\$5.3

**Table III-4: Streams of Benefits, Costs, and Net Benefits, by Year and by 65-Year Total
Based upon Varying Annual Benefits and Costs, Annualized over 65 Years**

	No Discount			3 Percent Discount Rate				7 Percent Discount Rate			
Year	Benefits (\$ Millions)	Costs (\$ Millions)	Net Benefit (\$ Millions)	Discount Factor	Discounted Benefits (\$ Millions)	Discounted Costs (\$ Millions)	Discounted Net Benefit (\$ Millions)	Discount Factor	Discounted Benefits (\$ Millions)	Discounted Costs (\$ Millions)	Discounted Net Benefit (\$ Millions)
28	\$72.4	\$21.0	\$51.4	0.4371	\$31.7	\$9.2	\$22.5	0.1504	\$10.9	\$3.2	\$7.7
29	\$73.8	\$21.0	\$52.8	0.4243	\$31.3	\$8.9	\$22.4	0.1406	\$10.4	\$3.0	\$7.4
30	\$74.8	\$21.0	\$53.8	0.4120	\$30.8	\$8.7	\$22.1	0.1314	\$9.8	\$2.8	\$7.1
31	\$75.4	\$42.6	\$32.8	0.4000	\$30.2	\$17.1	\$13.1	0.1228	\$9.3	\$5.2	\$4.0
32	\$75.8	\$37.4	\$38.4	0.3883	\$29.5	\$14.5	\$14.9	0.1147	\$8.7	\$4.3	\$4.4
33	\$76.1	\$21.0	\$55.1	0.3770	\$28.7	\$7.9	\$20.8	0.1072	\$8.2	\$2.3	\$5.9
34	\$76.3	\$21.0	\$55.2	0.3660	\$27.9	\$7.7	\$20.2	0.1002	\$7.6	\$2.1	\$5.5
35	\$76.3	\$21.0	\$55.3	0.3554	\$27.1	\$7.5	\$19.7	0.0937	\$7.2	\$2.0	\$5.2
36	\$76.4	\$42.5	\$33.9	0.3450	\$26.4	\$14.7	\$11.7	0.0875	\$6.7	\$3.7	\$3.0
37	\$76.4	\$37.4	\$39.0	0.3350	\$25.6	\$12.5	\$13.1	0.0818	\$6.3	\$3.1	\$3.2
38	\$76.4	\$21.0	\$55.4	0.3252	\$24.9	\$6.8	\$18.0	0.0765	\$5.8	\$1.6	\$4.2
39	\$76.4	\$21.0	\$55.4	0.3158	\$24.1	\$6.6	\$17.5	0.0715	\$5.5	\$1.5	\$4.0
40	\$76.5	\$21.0	\$55.4	0.3066	\$23.4	\$6.4	\$17.0	0.0668	\$5.1	\$1.4	\$3.7
41	\$76.5	\$42.6	\$33.8	0.2976	\$22.8	\$12.7	\$10.1	0.0624	\$4.8	\$2.7	\$2.1
42	\$76.5	\$37.4	\$39.0	0.2890	\$22.1	\$10.8	\$11.3	0.0583	\$4.5	\$2.2	\$2.3
43	\$76.5	\$21.0	\$55.4	0.2805	\$21.4	\$5.9	\$15.5	0.0545	\$4.2	\$1.1	\$3.0
44	\$76.5	\$21.0	\$55.4	0.2724	\$20.8	\$5.7	\$15.1	0.0509	\$3.9	\$1.1	\$2.8
45	\$76.5	\$21.0	\$55.4	0.2644	\$20.2	\$5.6	\$14.7	0.0476	\$3.6	\$1.0	\$2.6
46	\$76.5		\$76.5	0.2567	\$19.6		\$19.6	0.0445	\$3.4		\$3.4
47	\$76.5		\$76.5	0.2493	\$19.1		\$19.1	0.0416	\$3.2		\$3.2
48	\$76.5		\$76.5	0.2420	\$18.5		\$18.5	0.0389	\$3.0		\$3.0
49	\$76.5		\$76.5	0.2350	\$18.0		\$18.0	0.0363	\$2.8		\$2.8
50	\$76.5		\$76.5	0.2281	\$17.4		\$17.4	0.0339	\$2.6		\$2.6
51	\$76.5		\$76.5	0.2215	\$16.9		\$16.9	0.0317	\$2.4		\$2.4
52	\$76.5		\$76.5	0.2150	\$16.4		\$16.4	0.0297	\$2.3		\$2.3
53	\$76.5		\$76.5	0.2088	\$16.0		\$16.0	0.0277	\$2.1		\$2.1
54	\$76.5		\$76.5	0.2027	\$15.5		\$15.5	0.0259	\$2.0		\$2.0
55	\$76.5		\$76.5	0.1968	\$15.0		\$15.0	0.0242	\$1.9		\$1.9
56	\$76.5		\$76.5	0.1910	\$14.6		\$14.6	0.0226	\$1.7		\$1.7

**Table III-4: Streams of Benefits, Costs, and Net Benefits, by Year and by 65-Year Total
Based upon Varying Annual Benefits and Costs, Annualized over 65 Years**

	No Discount			3 Percent Discount Rate				7 Percent Discount Rate			
Year	Benefits (\$ Millions)	Costs (\$ Millions)	Net Benefit (\$ Millions)	Discount Factor	Discounted Benefits (\$ Millions)	Discounted Costs (\$ Millions)	Discounted Net Benefit (\$ Millions)	Discount Factor	Discounted Benefits (\$ Millions)	Discounted Costs (\$ Millions)	Discounted Net Benefit (\$ Millions)
57	\$76.5		\$76.5	0.1855	\$14.2		\$14.2	0.0211	\$1.6		\$1.6
58	\$76.5		\$76.5	0.1801	\$13.8		\$13.8	0.0198	\$1.5		\$1.5
59	\$76.5		\$76.5	0.1748	\$13.4		\$13.4	0.0185	\$1.4		\$1.4
60	\$76.5		\$76.5	0.1697	\$13.0		\$13.0	0.0173	\$1.3		\$1.3
61	\$76.5		\$76.5	0.1648	\$12.6		\$12.6	0.0161	\$1.2		\$1.2
62	\$76.5		\$76.5	0.1600	\$12.2		\$12.2	0.0151	\$1.2		\$1.2
63	\$76.5		\$76.5	0.1553	\$11.9		\$11.9	0.0141	\$1.1		\$1.1
64	\$76.5		\$76.5	0.1508	\$11.5		\$11.5	0.0132	\$1.0		\$1.0
65	\$76.5		\$76.5	0.1464	\$11.2		\$11.2	0.0123	\$0.9		\$0.9
Total	\$3,440.6	\$1,283.5	\$2,157.0		\$1,050.2	\$706.2	\$344.0		\$281.7	\$396.5	-\$114.7

Annualized Values (65 Years, \$ millions)

	\$52.9	\$19.7	\$33.2		\$36.9	\$24.8	\$12.1		\$20.0	\$28.1	-\$8.1
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**Table III-5: Streams of Benefits, Costs, and Net Benefits, by Year and by 65-Year Total
Based upon Varying Annual Benefits and Costs, Annualized over 45 Years**

	No Discount			3 Percent Discount Rate				7 Percent Discount Rate			
Year	Benefits (\$ Millions)	Costs (\$ Millions)	Net Benefit (\$ Millions)	Discount Factor	Discounted Benefits (\$ Millions)	Discounted Costs (\$ Millions)	Discounted Net Benefit (\$ Millions)	Discount Factor	Discounted Benefits (\$ Millions)	Discounted Costs (\$ Millions)	Discounted Net Benefit (\$ Millions)
1	\$0.0	\$39.6	-\$39.6	0.9709	\$0.0	\$38.4	-\$38.4	0.9346	\$0.0	\$37.0	-\$37.0
2	\$0.0	\$35.2	-\$35.2	0.9426	\$0.0	\$33.2	-\$33.2	0.8734	\$0.0	\$30.8	-\$30.8
3	\$0.0	\$21.9	-\$21.9	0.9151	\$0.0	\$20.0	-\$20.0	0.8163	\$0.0	\$17.8	-\$17.8
4	\$0.0	\$21.2	-\$21.2	0.8885	\$0.0	\$18.8	-\$18.8	0.7629	\$0.0	\$16.2	-\$16.2
5	\$0.0	\$21.0	-\$21.0	0.8626	\$0.0	\$18.1	-\$18.1	0.7130	\$0.0	\$15.0	-\$15.0
6	\$0.0	\$42.5	-\$42.5	0.8375	\$0.0	\$35.6	-\$35.6	0.6663	\$0.0	\$28.3	-\$28.3
7	\$0.0	\$37.4	-\$37.4	0.8131	\$0.0	\$30.4	-\$30.4	0.6227	\$0.0	\$23.3	-\$23.3
8	\$0.1	\$21.0	-\$21.0	0.7894	\$0.0	\$16.6	-\$16.6	0.5820	\$0.0	\$12.2	-\$12.2
9	\$0.2	\$21.0	-\$20.9	0.7664	\$0.1	\$16.1	-\$16.0	0.5439	\$0.1	\$11.4	-\$11.4
10	\$0.4	\$21.0	-\$20.6	0.7441	\$0.3	\$15.6	-\$15.4	0.5083	\$0.2	\$10.7	-\$10.5
11	\$0.8	\$42.6	-\$41.8	0.7224	\$0.6	\$30.8	-\$30.2	0.4751	\$0.4	\$20.3	-\$19.9
12	\$1.6	\$37.4	-\$35.8	0.7014	\$1.1	\$26.3	-\$25.1	0.4440	\$0.7	\$16.6	-\$15.9
13	\$3.0	\$21.0	-\$18.0	0.6810	\$2.0	\$14.3	-\$12.3	0.4150	\$1.2	\$8.7	-\$7.5
14	\$5.1	\$21.0	-\$16.0	0.6611	\$3.3	\$13.9	-\$10.6	0.3878	\$2.0	\$8.2	-\$6.2
15	\$8.0	\$21.0	-\$13.0	0.6419	\$5.1	\$13.5	-\$8.4	0.3624	\$2.9	\$7.6	-\$4.7
16	\$12.0	\$42.5	-\$30.5	0.6232	\$7.5	\$26.5	-\$19.0	0.3387	\$4.1	\$14.4	-\$10.3
17	\$16.9	\$37.4	-\$20.5	0.6050	\$10.2	\$22.6	-\$12.4	0.3166	\$5.4	\$11.9	-\$6.5
18	\$22.7	\$21.0	\$1.7	0.5874	\$13.3	\$12.4	\$1.0	0.2959	\$6.7	\$6.2	\$0.5
19	\$29.2	\$21.0	\$8.1	0.5703	\$16.6	\$12.0	\$4.6	0.2765	\$8.1	\$5.8	\$2.2
20	\$36.0	\$21.0	\$14.9	0.5537	\$19.9	\$11.6	\$8.3	0.2584	\$9.3	\$5.4	\$3.9
21	\$42.7	\$41.8	\$1.0	0.5375	\$23.0	\$22.5	\$0.5	0.2415	\$10.3	\$10.1	\$0.2
22	\$49.2	\$38.3	\$10.9	0.5219	\$25.7	\$20.0	\$5.7	0.2257	\$11.1	\$8.6	\$2.5
23	\$55.1	\$21.0	\$34.1	0.5067	\$27.9	\$10.7	\$17.3	0.2109	\$11.6	\$4.4	\$7.2
24	\$60.2	\$21.0	\$39.2	0.4919	\$29.6	\$10.3	\$19.3	0.1971	\$11.9	\$4.1	\$7.7
25	\$64.5	\$21.0	\$43.4	0.4776	\$30.8	\$10.0	\$20.7	0.1842	\$11.9	\$3.9	\$8.0
26	\$67.9	\$42.5	\$25.4	0.4637	\$31.5	\$19.7	\$11.8	0.1722	\$11.7	\$7.3	\$4.4
27	\$70.5	\$37.4	\$33.1	0.4502	\$31.7	\$16.9	\$14.9	0.1609	\$11.3	\$6.0	\$5.3
28	\$72.4	\$21.0	\$51.4	0.4371	\$31.7	\$9.2	\$22.5	0.1504	\$10.9	\$3.2	\$7.7

**Table III-5: Streams of Benefits, Costs, and Net Benefits, by Year and by 65-Year Total
Based upon Varying Annual Benefits and Costs, Annualized over 45 Years**

	No Discount			3 Percent Discount Rate				7 Percent Discount Rate			
Year	Benefits (\$ Millions)	Costs (\$ Millions)	Net Benefit (\$ Millions)	Discount Factor	Discounted Benefits (\$ Millions)	Discounted Costs (\$ Millions)	Discounted Net Benefit (\$ Millions)	Discount Factor	Discounted Benefits (\$ Millions)	Discounted Costs (\$ Millions)	Discounted Net Benefit (\$ Millions)
29	\$73.8	\$21.0	\$52.8	0.4243	\$31.3	\$8.9	\$22.4	0.1406	\$10.4	\$3.0	\$7.4
30	\$74.8	\$21.0	\$53.8	0.4120	\$30.8	\$8.7	\$22.1	0.1314	\$9.8	\$2.8	\$7.1
31	\$75.4	\$42.6	\$32.8	0.4000	\$30.2	\$17.1	\$13.1	0.1228	\$9.3	\$5.2	\$4.0
32	\$75.8	\$37.4	\$38.4	0.3883	\$29.5	\$14.5	\$14.9	0.1147	\$8.7	\$4.3	\$4.4
33	\$76.1	\$21.0	\$55.1	0.3770	\$28.7	\$7.9	\$20.8	0.1072	\$8.2	\$2.3	\$5.9
34	\$76.3	\$21.0	\$55.2	0.3660	\$27.9	\$7.7	\$20.2	0.1002	\$7.6	\$2.1	\$5.5
35	\$76.3	\$21.0	\$55.3	0.3554	\$27.1	\$7.5	\$19.7	0.0937	\$7.2	\$2.0	\$5.2
36	\$76.4	\$42.5	\$33.9	0.3450	\$26.4	\$14.7	\$11.7	0.0875	\$6.7	\$3.7	\$3.0
37	\$76.4	\$37.4	\$39.0	0.3350	\$25.6	\$12.5	\$13.1	0.0818	\$6.3	\$3.1	\$3.2
38	\$76.4	\$21.0	\$55.4	0.3252	\$24.9	\$6.8	\$18.0	0.0765	\$5.8	\$1.6	\$4.2
39	\$76.4	\$21.0	\$55.4	0.3158	\$24.1	\$6.6	\$17.5	0.0715	\$5.5	\$1.5	\$4.0
40	\$76.5	\$21.0	\$55.4	0.3066	\$23.4	\$6.4	\$17.0	0.0668	\$5.1	\$1.4	\$3.7
41	\$76.5	\$42.6	\$33.8	0.2976	\$22.8	\$12.7	\$10.1	0.0624	\$4.8	\$2.7	\$2.1
42	\$76.5	\$37.4	\$39.0	0.2890	\$22.1	\$10.8	\$11.3	0.0583	\$4.5	\$2.2	\$2.3
43	\$76.5	\$21.0	\$55.4	0.2805	\$21.4	\$5.9	\$15.5	0.0545	\$4.2	\$1.1	\$3.0
44	\$76.5	\$21.0	\$55.4	0.2724	\$20.8	\$5.7	\$15.1	0.0509	\$3.9	\$1.1	\$2.8
45	\$76.5	\$21.0	\$55.4	0.2644	\$20.2	\$5.6	\$14.7	0.0476	\$3.6	\$1.0	\$2.6
46	\$76.5		\$76.5	0.2567	\$19.6		\$19.6	0.0445	\$3.4		\$3.4
47	\$76.5		\$76.5	0.2493	\$19.1		\$19.1	0.0416	\$3.2		\$3.2
48	\$76.5		\$76.5	0.2420	\$18.5		\$18.5	0.0389	\$3.0		\$3.0
49	\$76.5		\$76.5	0.2350	\$18.0		\$18.0	0.0363	\$2.8		\$2.8
50	\$76.5		\$76.5	0.2281	\$17.4		\$17.4	0.0339	\$2.6		\$2.6
51	\$76.5		\$76.5	0.2215	\$16.9		\$16.9	0.0317	\$2.4		\$2.4
52	\$76.5		\$76.5	0.2150	\$16.4		\$16.4	0.0297	\$2.3		\$2.3
53	\$76.5		\$76.5	0.2088	\$16.0		\$16.0	0.0277	\$2.1		\$2.1
54	\$76.5		\$76.5	0.2027	\$15.5		\$15.5	0.0259	\$2.0		\$2.0
55	\$76.5		\$76.5	0.1968	\$15.0		\$15.0	0.0242	\$1.9		\$1.9
56	\$76.5		\$76.5	0.1910	\$14.6		\$14.6	0.0226	\$1.7		\$1.7
57	\$76.5		\$76.5	0.1855	\$14.2		\$14.2	0.0211	\$1.6		\$1.6

**Table III-5: Streams of Benefits, Costs, and Net Benefits, by Year and by 65-Year Total
Based upon Varying Annual Benefits and Costs, Annualized over 45 Years**

	No Discount			3 Percent Discount Rate				7 Percent Discount Rate			
Year	Benefits (\$ Millions)	Costs (\$ Millions)	Net Benefit (\$ Millions)	Discount Factor	Discounted Benefits (\$ Millions)	Discounted Costs (\$ Millions)	Discounted Net Benefit (\$ Millions)	Discount Factor	Discounted Benefits (\$ Millions)	Discounted Costs (\$ Millions)	Discounted Net Benefit (\$ Millions)
58	\$76.5		\$76.5	0.1801	\$13.8		\$13.8	0.0198	\$1.5		\$1.5
59	\$76.5		\$76.5	0.1748	\$13.4		\$13.4	0.0185	\$1.4		\$1.4
60	\$76.5		\$76.5	0.1697	\$13.0		\$13.0	0.0173	\$1.3		\$1.3
61	\$76.5		\$76.5	0.1648	\$12.6		\$12.6	0.0161	\$1.2		\$1.2
62	\$76.5		\$76.5	0.1600	\$12.2		\$12.2	0.0151	\$1.2		\$1.2
63	\$76.5		\$76.5	0.1553	\$11.9		\$11.9	0.0141	\$1.1		\$1.1
64	\$76.5		\$76.5	0.1508	\$11.5		\$11.5	0.0132	\$1.0		\$1.0
65	\$76.5		\$76.5	0.1464	\$11.2		\$11.2	0.0123	\$0.9		\$0.9
Total	\$3,440.6	\$1,283.5	\$2,157.0		\$1,050.2	\$706.2	\$344.0		\$281.7	\$396.5	-\$114.7

Annualized Values (45 Years, \$ millions)

	\$76.5	\$28.5	\$47.9		\$42.8	\$28.8	\$14.0		\$20.7	\$29.1	-\$8.4
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IV. COMPLIANCE COSTS

INTRODUCTION

This section presents MSHA's estimates of costs incurred by underground and surface coal mine operators to comply with the final rule. These costs are based on MSHA's assessment of the actions operators will take to comply with the final rule. The costs in this chapter are presented by mine employment sizes: 1-19 employees, 20-500 employees, and 501+ employees.

MSHA estimates, in Table IV-1, that total first year costs (excluding penalties from citations and costs to the government) of the final rule to coal mine operators will be \$61 million (\$52.7 million for underground coal mine operators and \$8.3 million for surface coal mine operators). For underground coal mine operators, Table IV-1 shows that the most significant first year costs are \$34.1 million for requirements to use CPDMs and \$10.7 million for upgrading and maintaining engineering controls and work practices. For surface coal mine operators, Table IV-1 shows that the most significant first year costs are \$3.9 million for the extension of the part 90 option to surface coal miners. The bottom of Table IV-1 shows that when \$0.4 million of costs to the government are added the total first year costs are \$61.4 million. Costs related to penalties from citations are shown in Table IV-3.

Final § 70.201(j) states that an anthracite mine using the full box, open breast, or slant breast mining method may use either a CPDM or a Coal Mine Dust Personal Sampler Unit (CMDPSU) to conduct the required sampling. In this analysis, the CMDPSU sampler is also referred to as a gravimetric sampler. To estimate the full extent of potential costs associated with complying with the final rule and the economic feasibility of financing these costs, the estimates derived in this chapter are based on the high cost scenario that anthracite mines affected by final § 70.201(j) will all choose to use the CPDM to conduct sampling.

Table IV-1: First Year Cost Estimates of Final Rule at a 7 Percent Discount Rate

Requirements	1-19	20-500	501+	Totals
Underground Operators				
Engineering Controls	\$353,500	\$8,959,700	\$1,380,900	\$10,694,200
Mine Ventilation Plan Changes	\$8,800	\$35,900	\$1,300	\$46,000
Abatement Costs	\$21,600	\$170,600	\$33,700	\$225,900
Costs Incurred When Samples Meet or Exceed the ECV	\$71,500	\$662,700	\$91,000	\$825,200
Certification to Sample & Maintain	\$138,700	\$1,629,400	\$171,300	\$1,939,300
Record of Production	\$103,000	\$2,247,600	\$0	\$2,350,600
Record of Shift Length	\$1,600	\$17,400	\$12,500	\$31,500
Using Gravimetric Sampler	-\$106,300	-\$1,122,500	-\$119,700	-\$1,348,600
Using CPDMs	\$2,500,500	\$29,054,000	\$2,510,300	\$34,064,800
On Shift Exams	\$114,400	\$3,000,400	\$454,900	\$3,569,700
Periodic Examinations	\$9,800	\$132,000	\$37,900	\$179,700
Respiratory Equipment Training	\$6,400	\$111,800	\$14,500	\$132,700
Underground Total	\$3,223,500	\$44,899,000	\$4,588,600	\$52,711,000
Surface Operators				
Engineering Controls	\$61,200	\$273,500	\$140,400	\$475,000
Abatement Costs	\$8,600	\$7,100	\$1,400	\$17,100
Certify to Sample & Maintain	\$326,600	\$355,100	\$5,300	\$687,000
Record of Shift Length	\$144,500	\$551,000	\$23,400	\$718,800
Using Gravimetric Sampler	\$657,400	\$1,142,200	\$27,500	\$1,827,100
Periodic Examinations	\$178,100	\$402,300	\$50,400	\$630,800
Respiratory Training	\$700	\$600	\$100	\$1,400
Extension of Part 90 Option to Surface Mines	\$592,300	\$2,923,900	\$431,300	\$3,947,500
Surface Total	\$1,969,400	\$5,655,700	\$679,800	\$8,304,700
ALL				
UG. & Surf. Total	\$5,192,900	\$50,554,700	\$5,268,400	\$61,015,700
Costs to Government				\$395,800
UG. & Surf. Total with Gov. Costs				\$61,411,500

First Year Costs include: costs that occur in the first year that do not repeat every year plus the annualized value of subsequent-year costs. Some costs in this table change in various years and then obtain equilibrium. For these costs, the present value was taken each year for a 10-year period and then summed. The sum was then annualized over a 10-year period at a 7 percent discount rate.

MSHA estimates, in Table IV-2, that total annualized costs (excluding penalties from citations and costs to the government) of the final rule to coal mine operators will be \$30.2 million (\$26.2 million for underground coal mine operators and \$4.0 million for surface coal mine operators. For underground coal mine operators, Table IV-2 shows that the most significant annualized costs are \$14.6 million for requirements to use CPDMs and \$5.1 million for upgrading and maintaining engineering controls and work practices. For surface coal mine

operators, Table IV-2 shows that the most significant annualized costs are \$1.1 million for using gravimetric samplers for expanding sampling requirements to apply to all surface coal mine operators and another \$1.1 million for the extension of the part 90 option to surface coal miners. The bottom of Table IV-2 shows that when \$0.4 million of costs to the government are added the total annualized costs are \$30.6 million. Costs related to penalties from citations are shown in Table IV-3.

Table IV-2: Annualized Cost Estimates of Final Rule at a 7 Percent Discount Rate

Requirements	1-19	20-500	501+	Totals
Underground Operators				
Engineering Controls	\$133,300	\$4,496,800	\$448,500	\$5,078,600
Mine Ventilation Plan Changes	\$1,200	\$5,100	\$200	\$6,500
Abatement Costs	\$21,600	\$170,600	\$33,700	\$225,900
Costs Incurred When Samples Meet or Exceed the ECV	\$71,500	\$662,700	\$91,000	\$825,200
Certification to Sample & Maintain	\$41,600	\$483,800	\$50,300	\$575,700
Record of Production	\$103,000	\$2,247,600	\$0	\$2,350,600
Record of Shift Length	\$1,600	\$17,400	\$12,500	\$31,500
Using Gravimetric Sampler	-\$106,400	-\$1,122,900	-\$119,900	-\$1,349,200
Using CPDMs	\$1,063,300	\$12,325,600	\$1,220,000	\$14,608,900
On Shift Exams	\$114,400	\$3,000,400	\$454,900	\$3,569,700
Periodic Examinations	\$8,600	\$127,200	\$37,800	\$173,500
Respiratory Equipment Training	\$6,400	\$111,800	\$14,500	\$132,700
Underground Total	\$1,460,100	\$22,526,100	\$2,243,500	\$26,229,600
Surface Operators				
Engineering Controls	\$48,900	\$185,500	\$102,100	\$336,500
Abatement Costs	\$8,600	\$7,100	\$1,400	\$17,100
Certify to Sample & Maintain	\$107,100	\$115,000	\$2,000	\$224,000
Record of Shift Length	\$144,500	\$551,000	\$23,400	\$718,800
Using Gravimetric Sampler	\$384,300	\$658,400	\$21,600	\$1,064,300
Periodic Examinations	\$139,000	\$370,800	\$50,200	\$559,900
Respiratory Training	\$700	\$600	\$100	\$1,400
Extension of Part 90 Option to Surface Mines	\$160,100	\$789,600	\$116,400	\$1,066,100
Surface Total	\$993,200	\$2,678,000	\$317,200	\$3,988,100
ALL				
UG. & Surf. Total	\$2,453,300	\$25,204,100	\$2,560,700	\$30,217,700
Costs to Government				\$395,800
UG. & Surf. With Gov. Costs				\$30,613,500

Annualized Costs = annualizing the costs that occur in the first year over the relevant service life of equipment plus ongoing costs.

Table IV-3 shows, by mine size, that under the final rule, MSHA estimates that operators will incur additional annualized penalties of \$889,200 from citations (\$864,300 for underground coal mine operators and \$24,900 for surface coal mine operators). It should be noted that

penalties conventionally are not considered to be a cost of a rule but are a transfer payment to the government from a party violating a standard. Therefore, the penalty estimates in Table IV-3 are not included in the compliance costs shown in Tables IV-1 or IV-2. However, these penalty estimates are relevant to the economic feasibility of the final rule. Therefore, the penalty estimates in Table IV-3 are included at the end of this chapter in the discussion of economic feasibility of the rule, and in the analysis that compares the impacts of the final rule with the industry's revenues that appears in Chapter VI of this analysis.

**Table IV-3: Annualized Penalty Estimates of Final Rule
at a 7 Percent Discount Rate**

Description	Penalties by Mine Size			
	1-19	20-500	501+	Total
Underground Coal Operators	\$32,977	\$670,861	\$160,463	\$864,300
Surface Coal Operators	\$11,022	\$11,575	\$2,296	\$24,894
Total	\$43,999	\$682,436	\$162,759	\$889,194

TERMINOLOGY

As in the proposed analysis, MSHA used its traditional method of presenting costs for this analysis. This presentation examines costs by year except that startup costs are amortized over the expected life of the equipment.

The list below explains the terminology.

- **First Year Costs:** First year costs are generally related to an initial capital purchase and associated costs. In this REA, First Year Costs include both startup costs and the amortized value of costs incurred in subsequent years, generally calculated with a seven percent discount rate.
- **Annualized Costs:** Annualized costs are the amortized startup costs plus the amortized value of costs incurred in subsequent years.
- **Annualization:** Annualization or amortization is the calculation that determines the steady stream of payments required to achieve a specified value using a discount rate. This evaluation has undiscounted (zero percent discount rate), three percent discount rate, and the overall preferred seven percent discount rate.

METHODOLOGY

For this Regulatory Economic Analysis (REA), MSHA annualized costs using the formula:

$$a = (i * (1 + i)^n) / ((1 + i)^n - 1),$$

where "a" equals the annualization factor; "i" equals the annual discount rate of 7 percent (as recommended by the Office of Management and Budget (OMB) for private investment discounting); and "n" equals the service life of the equipment or time horizon of the analysis.

MSHA used two specific annualization factors for equipment costs: 0.244 for equipment with a 5-year service life and 0.142 for equipment with a 10-year service life (both using a

7 percent discount rate). For example, the annualized cost of a \$1,000 piece of equipment that has a service life of 5 years will be \$244 ($\$1,000 \times 0.244$).

Several provisions of the final rule result in costs that occur every year, but begin at some time in the future. To estimate annualized costs for these provisions, MSHA calculated the present value of the costs occurring each year over a 10-year period⁵, summed the present values and then annualized the sum of the present values. For example, the cost of filters for sampling with CPDMs begins 18 months after the final rule is in effect. If the cost of filters is \$100 per year 18 months after the final rule is in effect, the present value of the costs of these filters for 10 years will be \$604.79 [the sum of the present value of a \$50 expenditure in the second half of the year (that is 18 months after the final rule is in effect) = \$46.70; the present value of \$100 in year three = \$87.30; the present value of \$100 in year 10 = \$54.40]. Annualizing the present value of \$604.79 over 10 years yields an annualized cost of \$85.88 ($\604.79×0.142). This is the same result as multiplying by a single discount factor of 0.859. For ease of calculations, MSHA used the 0.859 discount factor to calculate the present value of annual costs that begin after 18 months. Both factors are based on a 7 percent rate. Costs that occur every year, such as maintenance and recordkeeping costs, are annual costs.

Other calculated cost estimates changed in every year and then became constant in the fifth year and every year thereafter. To calculate annualized cost estimates for these provisions, the Agency multiplied each year's costs by the appropriate discount factor. The discount factor is derived by using the formula $1/(1+0.07)^{n-1}$, where "n" equals the number of years. MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on 7 percent.

As discussed in Chapter V, MSHA's benefits estimates are based upon 5 years of exposure data and 2009 employment estimates by occupation. Thus, 2009 was established as the reference year for the benefits. However to account for changes in pricing, MSHA has updated the estimates of hourly wage rates and average underground and surface coal price per ton that are used in this analysis.

For underground coal mines, MSHA based many of its cost estimates in this analysis on the average number of MMUs in operation for 12 monthly periods ending January 2010. These were the same number of MMUs (881 MMUs) used in the PREA: 81 MMUs in mines with 1-19 employees; 708 MMUs in mines with 20-500 employees (of which 22 MMUs are longwall MMUs); and 92 MMUs in mines with 501+ employees (of which 20 MMUs are longwall MMUs).

Hourly wage rates used in the PREA and in this analysis were derived from data obtained from InfoMine USA, Inc.⁶ The hourly wage rates used in the PREA that accompanied the

⁵ MSHA believes using a 10-year time horizon is a reasonable approach for converting costs beginning in the second year to equivalent costs beginning in the first year. The life span of individual mines varies significantly, with some operating for very short periods and others for many years. Assuming a longer time horizon will increase annualized costs (e.g., a 15-year time horizon will result in annualized costs of \$96.02 for a \$100 expenditure beginning in the second year), while assuming a shorter time horizon will reduce annualized costs (e.g., a 5-year time horizon will result in annualized costs of \$82.61 for a \$100 expenditure beginning in the second year).

⁶ InfoMines USA, Inc., *U.S. Coal Mine Salaries, Wages and Benefits 2010 Survey Results*, U.S., 2010. Although the wage rates include benefits such as social security, unemployment insurance, and workers' compensation, they do not reflect shift differentials or overtime pay. MSHA refers to miner "compensation" in this REA as "wages,"

proposed rule were based on 2009 data. The hourly rates used in this analysis are based on 2010 data.

The 2008 average price of coal per ton for underground coal and surface coal mines was used in the PREA to determine coal mine revenues. In this analysis, the 2010 average price of coal (\$60.73 per ton for underground coal mines and \$24.13 for surface coal mines) is used to determine coal mine revenues.

Some of the cost estimates in this analysis were based on the number of underground and surface coal mines (see Chapter 2, Tables II-1 and II-3) and on an estimate of the number of production shifts. MSHA also assumed a six percent turnover rate for underground coal miners and a three percent turnover rate for surface coal miners. Unless otherwise noted, the term “shift” used in this analysis refers to production shifts. Cost estimates in this chapter are based on MSHA expertise and routine discussion with manufacturers and mine operators. Finally, some of the totals in the tables may not sum due to rounding.

COST ESTIMATES FOR GOVERNMENT

MSHA will incur two types of costs to implement the final rule. First, MSHA will incur increased costs related to current MSHA activities to support implementation of the final rule (such as, the change in respirable coal mine dust sampling). Second, MSHA will incur increased costs related to handling the electronic filing of CPDM sampling data submitted by underground and surface coal operators.

MSHA estimates that increased annual costs for current MSHA activities to support the implementation of the final rule will be \$284,939. Specifically, the \$284,939 includes: \$148,212 for personnel costs; \$116,167 for contractor staff; \$4,600 for maintenance on software licensing, printer, and supplies; and \$15,900 for data mailers and postage.

MSHA will also incur costs to handle the CPDM sampling data supplied to MSHA by operators that is required by the final rule. In the first year of the final rule, MSHA will incur a one-time cost of \$519,000 (\$400,000 for application maintenance, \$104,000 for hardware maintenance, and \$15,000 for software licensing). For data storage of the CPDM sampling data submitted to MSHA by operators, MSHA will incur a one-time cost of \$210,000 in the second year of the rule and a one-time cost of \$75,000 in the third year of the rule. MSHA will not incur any increased costs with handling the CPDM sampling data submitted by operators in the fourth year of the rule and every year thereafter. Any ongoing maintenance costs associated with handling the CPDM sampling data submitted by operators in the fourth year of the final rule and every year thereafter can be handled at current budget funding levels.

Under the final rule, the cost to handle the CPDM sampling data being supplied by underground and surface operators changes each year until the fourth year and every year thereafter when it will be zero. The Agency estimated costs that will be incurred over a 10-year period by multiplying each year’s costs (excluding the cost in the first year) by a discount factor.

where that term is understood to include benefits. In addition, geographical variations and union and non-union variables are accounted for in the wage data collected by InfoMine USA and are also accounted for in wages presented in this analysis.

MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at an annual cost estimate of \$110,847.

Thus, total annualized costs to government are approximately \$395,800 (\$284,939 + \$110,847).

COST ESTIMATES FOR COAL MINE OPERATORS

Engineering Controls and Work Practices

MSHA used inspector experience, data collected during inspections, the exposure data presented in the technological feasibility analysis, and public comments to project the needed engineering controls and work practices. Estimates for these engineering controls and work practices are presented in this section.

Installing Engineering Controls to Meet Lower Respirable Dust Standards

The final rule lowers the respirable coal mine dust standard for surface and underground coal mines from 2.0 mg/m³ to 1.5 mg/m³ 24 months after the effective date of the final rule (final §§ 70.100(a), 71.100). The final rule requires the respirable coal mine dust standard be further reduced when a respirable coal mine dust sample contains more than 100 ug/m³ quartz (final §§ 70.101, 71.101, 90.101). The final rule also reduces the respirable coal mine dust levels from 1.0 mg/m³ to 0.5 mg/m³ 24 months after the effective date of the final rule for: intake air courses; belt air courses, and part 90 miners (final §§ 70.100(b), 75.350(b)(3)(i), and 90.100). In addition to lowering the standards, the final rule also changes the way compliance is determined.

Final §§ 70.201(c), 71.201(b) and 90.201(b) require full-shift sampling. Under final §§ 70.206(f), 70.207(e), 70.209(d), 71.206(i), and 90.207(d) noncompliance determinations for operator samples are based on either two or more valid, representative operator samples in a sampling period meeting or exceeding the applicable Excessive Concentration Value (ECV), or the average of all valid, representative operator samples in a sampling period meeting or exceeding the applicable ECV. An ECV is the excessive concentration measurement demonstrating that the applicable dust standard has been exceeded at a confidence level of at least 95 percent. Under final § 70.208(f), noncompliance determinations for operator samples are based on either three or more valid, representative operator samples in a sampling period meeting or exceeding the ECV, or the average of all valid, representative samples in a sampling period meeting or exceeding the applicable ECV. Under final § 72.800, noncompliance determinations for MSHA inspector samples are based on a single, full shift sample.

As discussed in Section III. C. of the preamble (Feasibility), these changes will require operators to take additional steps to meet the final requirements. Costs are presented for both normal mining operations and operations that MSHA anticipates will incur above average costs (such as some operations subject to an existing reduced standard of less than 1.5 mg/m³ due to the presence of quartz). Costs are presented separately for surface and underground operations by mine size.

Some engineering controls will need to be applied throughout the mine, while others will be specific to an MMU. The types and unit costs of engineering controls that operators are

expected to implement as a result of the final rule are discussed below. Tables are then presented showing MSHA's estimate of the total costs, by mine size, to implement the engineering controls. The discussion focuses first on underground coal mines and then on surface coal mines.

Many of the engineering controls discussed later in this section are the same as stated in the PREA. For underground coal mines, some commenters stated that these controls would not reduce dust to levels at or below 1.0 mg/m^3 on each shift. However, MSHA believes that, under the final rule, these engineering controls could be used by underground coal mine operators to comply with the 1.5 mg/m^3 respirable coal mine dust standard, which must be achieved 24 months after the effective date of the rule.

Commenters also stated that these engineering controls could not be used to further reduce dust levels at underground coal mines because these controls have been optimized. However, as discussed in Section III.C. in the preamble (Feasibility) to the final rule, MSHA and NIOSH have found many instances where dust controls were either not used, not present, or not working properly. The REA develops costs for many of the same engineering controls that were used in the PREA. However, in response to comments and because of the requirements of the final rule, MSHA estimates that fewer underground coal mines and MMUs will require these controls.

Respirable coal mine dust sampling data show that 10 out of the 11 underground anthracite mines, that have 1-19 employees, are able to comply with the final 1.5 mg/m^3 standard and will not need to install additional engineering controls; therefore, MSHA did not include these mines in the Agency's engineering control cost estimates. For mines with 1-19 employees, 71 MMUs (81 MMUs – 10 MMUs) were used in the Agency's engineering control cost estimates. Data for the remaining underground anthracite coal mine indicate that miner exposures are similar to those of other mines using comparable equipment.

There were no comments on MSHA's estimate of engineering controls for surface coal mine operators to comply with the proposed rule. However, due to comments on engineering controls from underground coal mine operators, the Agency reexamined its estimate of the controls needed for surface coal mines to comply with the final rule. This analysis did not result in a change in the types of controls or costs of those controls estimated in the PREA for surface coal mines; however, MSHA did increase the number of engineering controls needed to comply with the final rule.

Underground Coal Mine Operators

When used successfully, engineering controls are the primary methods to reduce dust levels in underground coal mines. To comply with the final rule's lower respirable coal mine dust standards, most operators will need to change or adjust controls that affect ventilation, dust suppression, and dust collection.

Engineering Controls Needed at Surface Areas of Underground Coal Mines

Refurbish Cab and Filter Changes

Dust concentrations associated with mobile equipment and fixed locations at surface

areas of underground coal mines can be controlled through the use of environmental cabs or enclosures. The cabs and enclosures are equipped with a filtration unit that removes and prevents outside dust from migrating inside the cab or the enclosure.

Based on MSHA enforcement experience, MSHA believes that some operators will need to refurbish their cabs to meet the final respirable dust standard. MSHA estimates that the cab of 1 bulldozer operating at a mine with 1-19 employees will need to be refurbished by changing the interior lining of the cab and sealing all cracks and holes at a cost of \$4,000.

The cab of a bulldozer has two cabin air filters. Air inside a cab can be compromised if these filters are not changed regularly. MSHA estimates that more frequent filter changes will be needed for: 1 bulldozer at a mine with 1-19 employees; 1 bulldozer at a mine with 20-500 employees; and 1 bulldozer at a mine with 501+ employees. Current practice among some operators is to change these filters once a month. To meet the final respirable dust standard, the filters need to be changed once a week, or an additional 3 times per month. MSHA estimates that an underground coal mine mechanic, earning \$36.77 per hour, takes 45 minutes (0.75 hours) to change the 2 filters, and that a filter costs \$50. MSHA estimates that the annual cost for more frequent filter changes for each cab will be \$4,593 [3 additional changes per mo. x 12 mos. x ((2 filters x \$50 per filter) + (0.75 hrs. x \$36.77 hourly wage rate))].

Enclosures, Portable Exhaust Fan and Tubing

In many cases, operators place miners in enclosures that are located in a processing plant. These enclosures protect miners from breathing air that is compromised by dust and other airborne particles. MSHA estimates that 1 processing plant at a mine with 20-500 employees and 1 processing plant at a mine with 501+ employees will need to repair 2 enclosures per processing plant. Repair costs consist of an underground coal mine mechanic, earning \$36.77 per hour, working, on average, 4 hours to seal cracks and leaks in the enclosure. MSHA estimates that the cost to repair 2 enclosures per plant will be \$294 (4 repair hours x \$36.77 hourly wage rate x 2 enclosures). Also, MSHA estimates that 1 processing plant in a mine with 20-500 employees will need a portable fan and tubing to capture localized welding fumes and/or grinding dust, at a cost of \$1,500.

Engineering Controls Needed at Underground Areas of Underground Coal Mines

Dust concentrations in underground coal mines can be controlled by using a combination of ventilation, water sprays, and work practices. MSHA has determined that not all of these dust control methods are used at every underground coal mine. MSHA estimates that most operators will have to modify and adjust existing controls to comply with the final rule. At some mines, particularly those operating under a reduced standard due to the presence of quartz, MSHA estimates that operators will have to adjust or install additional controls in underground areas and modify their methods of mining.

Adjust Regulators

MSHA estimates that the number of underground coal mines that will need to adjust regulators to increase the air flow at the working areas of the mine is: 71 mines with 1-19 employees; 331 mines with 20-500 employees; and 12 mines with 501+ employees. MSHA estimates that, on average, it costs \$200 per mine to adjust regulators and take air readings to assure that adjustments are correct.

Water Pressure Pumps

Some underground coal mines will need to install water pressure pumps to increase the flow rate and pressure of the water delivered to the MMU. MSHA estimates that the number of underground coal mines that need to install additional pumps is: 18 mines with 1-19 employees; 33 mines with 20-500 employees; and 3 mines with 501+ employees. MSHA estimates that the cost of a pump ranges from \$7,500 to \$10,000, for an average cost of \$8,750. MSHA further estimates that: each mine with 1-19 employees will need 1 additional pump costing \$8,750 (1 pump x \$8,750); and each mine with 20 or more employees will need 3 additional pumps at a cost of \$26,250 (3 pumps x \$8,750).

Adjust Fan Blades

MSHA estimates that 331 underground coal mines with 20-500 employees and 12 underground coal mines with 501+ employees will need to adjust fan blades to increase the quantities of air delivered by the main and bleeder fans to underground areas of the mine. MSHA estimates that adjusting fan blades costs \$600 per mine.

Surfactant Systems

In the PREA, the Agency estimated that 3 underground coal mines (each with 20-500 employees) would need to install a surfactant system to reduce the quartz content of the dust. One commenter questioned whether a surfactant system is an engineering control that would work. On further examination, MSHA cannot assure the effectiveness of this type of engineering control; therefore, this control is not included in this analysis.

Sinking a Shaft

In the PREA, MSHA estimated that one mine operator would need to sink an additional shaft costing \$10 million to comply with the proposed rule. One commenter stated that sinking a shaft approximately 3,200 feet deep would be a prohibitive cost for the mine. Another commenter noted that it could take up to 3 years to locate and sink an additional shaft and during that time major ventilation changes could not be implemented quick enough to prevent extended periods of noncompliance. Under the final rule requirements, MSHA does not believe that it will be necessary for any mine to sink an additional shaft because MSHA determined that the additional ventilating air necessary for active mining is already available under existing ventilation regulations. The proposed standard that would have required a separate intake airway for each MMU could have necessitated installation of an additional ventilating air shaft. The proposed provision that would have required a separate intake airway for each MMU was not included in the final rule.

Adjust Water Sprays and Increase Orifice Size

MSHA assumes that, at MMUs in certain mines, operators will need to adjust water sprays and increase the flow rate of sprays by changing the orifice size of the spray on continuous mining machines and longwall equipment. MSHA estimates that these functions need to be performed at all non-longwall MMUs at mines with 1-19 employees, and 25 percent of non-longwall MMUs at mines with 20 or more employees. Also, these functions need to be performed at all longwall MMUs. Therefore, the MMUs affected are: 71 MMUs in mines with 1-19 employees; 172 non-longwall MMUs and 22 longwall MMUs in mines with 20-500 employees; and 18 non-longwall MMUs and 20 longwall MMUs in mines with 501+ employees. MSHA estimates that the initial cost of adjusting water sprays is \$800 on a non-longwall MMU and \$2,000 on a longwall MMU. MSHA also estimates that the initial cost of increasing the

flow rate of sprays by changing the orifice size of the spray is \$300 on a non-longwall MMU and \$800 on a longwall MMU.

Belting for Continuous Mining Machines

MSHA estimates that to reduce dust at MMUs in some mines, operators will need to install a barrier over the conveyor opening of the continuous mining machine to confine the dust for better control by water sprays and ventilation. MSHA estimates that this will be done at: 71 MMUs in mines with 1-19 employees; 172 non-longwall MMUs in mines with 20-500 employees; and 18 non-longwall MMUs in mines with 501+ employees. MSHA estimates that the cost, including labor to install belting on the continuous mining machine, is \$300 per machine.

Headgate Shield Deflectors and Headgate Scrubber System

MSHA estimates that all longwall MMUs (22 in mines with 20-500 employees and 20 in mines with 501+ employees) will need to install headgate shield deflectors at a cost of \$1,300 per MMU and a headgate scrubber system at a cost of \$30,000 per MMU. Although no one commented on these costs, a commenter questioned whether a headgate scrubber system is an effective engineering control. MSHA believes that a headgate scrubber system is effective in reducing respirable coal mine dust. An article by Jayaraman, et. al. noted that significant dust reduction for longwall face workers is realized through the use of highly effective dust scrubbers.⁷ In addition, another article by Jayaraman, presented at the Longwall U.S.A. Conference held in Pittsburgh, Pennsylvania in June 1992, reported that the effectiveness of water-powered scrubbers at stage loaders and fan-powered scrubbers on stage loaders was excellent in providing significant dust reductions for face workers.⁸

Sprays at Transfer Points

MSHA estimates that MMUs in mines that use belt air as intake air will need to add water spray connections to belt transfer points to wet coal to reduce respirable coal mine dust. MSHA estimates that the cost (including labor) to add the spray connections will be \$500 per MMU. Annual maintenance costs are minimal. MSHA estimates the number of affected MMUs are: 2 MMUs in mines with 1-19 employees; 59 MMUs in mines with 20-500 employees; and 15 MMUs in mines with 501+ employees.

Exhaust Fan

MSHA estimates that 34 non-longwall MMUs in mines with 20-500 employees and 4 non-longwall MMUs in mines with 501+ employees need exhaust fans on the MMU to help control respirable dust. MSHA estimates that an exhaust fan costs \$100,000 per MMU and tubing needed for the exhaust fan costs \$7,500. In addition, due to normal wear and tear to tubing, MSHA estimates that \$750 of replacement tubing is needed each year. MSHA estimates that the additional electrical cost to operate an exhaust fan is \$100 per day. Therefore, MSHA estimates that additional annual electrical cost to operate an exhaust fan on an MMU is: \$30,000 per MMU in a mine with 20-500 employees (\$100 per day x 300 days); and \$35,000 per MMU

⁷ U.S. Department of the Interior, Bureau of Mines, Jayaraman, N.I., et. al., *Update on Longwall Dust Control Research*, July 1992.

⁸ Jayaraman, N.I., et al., *Update on Stage Loader Dust Control in Longwall Operations*, Longwall U.S.A. Conference, Pittsburgh, PA, June 16-18, 1992, pp 1-12.

in a mine with 501+ employees (\$100 per day x 350 days).

Change Scrubber Screen Size and Retrofit Dust Collector

Based on 2009 data, MSHA estimates that 4 non-longwall MMUs in mines with 1-19 employees and 25 non-longwall MMUs in mines with 20-500 employees that operated on a reduced standard of 0.5 mg/m^3 or less will need to use a more efficient scrubber screen on continuous mining machines and to retrofit dust collectors on roof bolters with twin heads (each head needs a dust collector) to accommodate a bagging system to reduce the quartz content of dust on the MMU. MSHA estimates that changing the scrubber screen size will cost \$800 per continuous mining machine. Retrofitting a dust collector on a roof bolter with twin heads to accommodate a bagging system will cost \$3,000 per MMU (1,500 per dust collector x 2 dust collectors x 1 roof bolter with twin heads). The costs per MMU to change the scrubber screen size on a continuous mining machine and retrofit dust collectors on a roof bolter machine with twin heads is \$3,800. Also, there are annual costs for dust collector bags that contain the dust captured by the dust collector. A roof bolter with twin heads is assumed to use 8 bags during a shift (4 bags per dust collector per shift). At a cost of \$9 per bag, MSHA estimates that the annual cost of bags for a roof bolter with twin heads operating on an MMU will be: \$14,400 in a mine with 1-19 employees (8 bags x \$9 per bag x 200 days); and \$43,200 in a mine with 20-500 employees (8 bags x \$9 per bag x 300 days x 2 shifts per day).

Cut to an Open Face

As thinner coal seams are mined it is often necessary to cut and remove rock above the seam of coal to obtain the needed working height for the equipment. Often the coal and rock are extracted simultaneously as the continuous mining machine cuts the coal and rock. Cutting rock may generate dust containing quartz. There is another method to mine called “cutting to an open face” that generates less dust. This technique involves first extracting the coal without cutting the rock. Once the coal is mined to the desired depth of the cut, the mining machine is brought back to the beginning of the cut to extract the rock to the needed mining height. This process reduces the amount of dust because the rock is removed in larger pieces as compared to cutting the rock and coal simultaneously.

In the PREA, MSHA estimated that some non-longwall MMUs in underground coal mines under a reduced standard below 1.0 mg/m^3 due to the presence of quartz may incur additional compliance costs because, under the proposed rule, changes that would have affected sampling would have taken effect immediately, before operators in these mines had time to implement additional engineering controls and revise work practices. MSHA estimated in the PREA that some of these non-longwall MMUs would need to change their mining practices to cut to an open face to minimize miners’ quartz exposure and meet the reduced standard.

Under the proposed rule, which would have established a 1.0 mg/m^3 respirable coal mine dust standard, MSHA determined that there were 38 MMUs operating on a reduced standard (due to the presence of quartz) below 1.0 mg/m^3 where 50 percent or more of operators’ samples exceeded the applicable standard. In the PREA, MSHA estimated that half of these, or 19 MMUs, would need to change their method of mining to cutting to an open face to comply with the proposed rule.

MSHA reexamined and revised the estimates of the number of MMUs that would need to change to cut to the open face to comply with the final 1.5 mg/m^3 standard. Based on MSHA’s experience, the Agency believes that nearly all MMUs that are currently operating on a reduced

standard due to the presence of quartz use the mining practice of cutting to an open face. However, rather than assume that cutting to the open face is a current practice for all MMUs on a reduced standard, MSHA estimates for this analysis that 2 MMUs in mines with 20-500 employees will need to change their mining methods to cut to an open face.

MSHA estimates that this change in mining practices will decrease the amount of coal mined per shift by 5 percent, which will result in increasing the operator's cost per ton of coal mined. However, this coal is not lost; the recovery of the coal is simply delayed by the change to cutting to an open face. In the PREA, MSHA assumed that the operator would extract the delayed coal production when the mine is at the end of its production life (which MSHA estimates to be 5 years). The value, in today's dollars, of a dollar of production 5 years from now is equal to one dollar discounted by 7 percent a year over 5 years (or, equivalently, one dollar multiplied by $[1/(1.07^5)]$, or 0.713). That is, the cost of delayed production is equal to $0.287 (1 - 0.713)$, multiplied by P, where P is equal to the value of 5 percent of production in today's dollars.

A commenter noted that, in developing the delayed production costs in the PREA, MSHA did not include in its analysis the variable costs that will be incurred during the delayed production. The commenter stated that delayed production is costly, not only because revenue is postponed, but also because variable costs (e.g., labor, rental equipment, energy costs) will be incurred while the production is being delayed. The commenter noted that MSHA recognized the existence of such variable costs in another regulatory analysis⁹ and, therefore, recommended that these costs be included in the calculation of any delayed production costs that result from this rulemaking. The commenter used the 0.5 factor in calculating lost production costs in testimony submitted for this rulemaking to account for the lost variable costs and recommended that MSHA use the 0.5 factor when calculating delayed production costs for analyses in this rulemaking. In response, MSHA uses a factor of 0.787 in this analysis (i.e., a 0.5 factor to account for lost variable costs plus a factor of 0.287 $(1 - 0.713)$ to account for the 5-year postponement of revenue) when calculating delayed production costs.

The annual value of the delayed production is \$463,165 per non-longwall MMU (193,815 tons per average non-longwall MMU x 5 percent delayed production x \$60.73 underground coal price per ton for 2010 x 0.787). The average annual production per non-longwall MMU of 193,815 tons was derived by multiplying 2009 total underground coal production by 49 percent to arrive at the total amount of production by non-longwall MMUs, and then dividing that product by the total number of non-longwall MMUs (331,858,793 tons x 0.49 / total 839 non-longwall MMUs). The 49 percent estimate is the percentage of total production mined by non-longwall MMUs and was obtained from Table 3 of the 2009 Annual Coal Report published by the Energy Information Agency.

The annual cost estimates of delayed production for non-longwall MMUs that change their mining method to cut to an open face are derived by multiplying the two affected

⁹ See U.S. Department of Labor, Mine Safety and Health Administration, Office of Standards, Regulations, and Variances, "Preliminary Regulatory Economic Analysis For The Proposed Rule Concerning Determination of Concentration of Respirable Coal Mine Dust and the Proposed Rule for Verification of Underground Coal Mine Operators' Dust Control Plans and Compliance Sampling for Respirable Dust", Document Numbers RIN-1219-AB18 & RIN-1219-AB14 (February 2003) (the "2003 PREA") at pp. 194-195.

non-longwall MMUs by \$463,165 (see Table IV-7).

Working Sections and Working Places

Proposed § 75.332(a)(1) would have required that each MMU where mechanized mining equipment is being installed or removed be ventilated by a separate split of intake air directed by overcasts, undercasts, or other permanent ventilation controls. In response to comments, which are discussed in the preamble to the final rule, this proposed standard is not included in the final rule.

Cost Estimates for Engineering Controls at Underground Coal Mines, by Mine Size

Underground Coal Mines with 1-19 Employees

Table IV-4 shows the costs of additional engineering controls likely to be used in the underground and surface areas of underground coal mines. Table IV-5 shows the costs to mine operators for additional engineering controls likely to be used at each MMU at underground coal mines. Total cost estimates are the sum of the costs from Tables IV-4 and IV-5. As noted previously, these costs do not apply to the 10 anthracite mines in this size category. These mines are not expected to need additional engineering controls to comply with the final standard.

First year cost estimates (costs that occur in the first year which do not repeat every year plus the annual costs) are \$353,493 (\$175,700 + \$4,593 from Table IV-4 and \$115,600 + \$57,600 from Table IV-5). Annualized cost estimates (annualizing the costs that occur in the first year over the relevant equipment lifespan plus the ongoing costs) are \$133,271 (\$42,871 + \$4,593 from Table IV-4 and \$28,207 + \$57,600 from Table IV-5).

**Table IV-4: Cost Estimates for Engineering Controls
Underground and Surface Areas of Underground Coal Mines
with 1-19 Employees**

Controls for Mine Size 1-19	Cost per Mine	Mines	First Year Costs	First Year Costs Annualized	Annual Costs
Adjust Regulators	\$200	71	\$14,200	\$3,465	
Water Pressure Pumps	\$8,750	18	\$157,500	\$38,430	
Surface Area of UG. Mines		Machines			
Refurbish Cab	\$4,000	1	\$4,000	\$976	
Change Filters	\$4,593	1			\$4,593
Total First Year Costs			\$175,700		
Total First Year Costs Annualized				\$42,871	
Total Annual Costs					\$4,593

First year cost estimates were annualized by multiplying them by a 5-year annualization factor of 0.244 based on a 7 percent discount rate.

**Table IV-5: Cost Estimates for Engineering Controls for MMUs
in Underground Coal Mines with 1-19 Employees**

Controls for Mine Size 1-19	Cost per MMU	MMUs	First Year Costs	First Year Costs Annualized	Annual Costs
Adjust Water Sprays	\$800				
Increase Orifice Size	\$300				
Belting for Cont. Mining Mach.	\$300				
Total	\$1,400	71	\$99,400	\$24,254	
Sprays at Transfer Pts.	\$500	2	\$1,000	\$244	
Change Scrubber Screen Size	\$800				
Retrofit Dust Collector	\$3,000				
Total	\$3,800	4	\$15,200	\$3,709	
Purchase Bags	\$14,400	4			\$57,600
Total First Year Costs			\$115,600		
Total First Year Costs Annualized				\$28,207	
Total Annual Costs					\$57,600

First year cost estimates were annualized by multiplying them by a 5-year annualization factor of 0.244 based on a 7 percent discount rate.

Underground Coal Mines with 20-500 Employees

Table IV-6 shows the costs of additional engineering controls likely to be used in the underground and surface areas of underground coal mines. Table IV-7 shows the costs to mine operators for additional engineering controls likely to be used at each MMU at underground coal mines. Total cost estimates are the sum of the costs from Tables IV-6 and IV-7.

First year cost estimates (costs that occur in the first year which do not repeat every year plus annual costs) are \$9 million (\$1.1 million + \$4,593 from Table IV-6 and \$4.8 million + \$3.1 million from Table IV-7). Annualized cost estimates (annualizing costs that occur in the first year over the relevant equipment lifespan plus the annual costs) are \$4.5 million (\$276,414 + \$4,593 from Table IV-6 and \$1.2 million + \$3.1 million from Table IV-7).

**Table IV-6: Cost Estimates for Engineering Controls
Underground and on the Surface of Underground Coal Mines
with 20-500 Employees**

Controls for Mine Size 20-500	Cost per Mine	Mines	First Year Costs	First Year Costs Annualized	Annual Costs
Adjust Fan Blades	\$600				
Adjust Regulators	\$200				
Total Cost per Mine	\$800	331	\$264,800	\$64,611	
Water Pressure Pumps	\$26,250	33	\$866,250	\$211,365	
Surface Areas of UG. Mines		Machines or Plants			
Change Filters	\$4,593	1			\$4,593
Repair Enclosures	\$294	1	\$294	\$72	
Portable Exhaust Fan & Tubing	\$1,500	1	\$1,500	\$366	
Total First Year Costs			\$1,132,844		
Total First Year Costs Annualized				\$276,414	
Total Annual Costs					\$4,593

First year cost estimates were annualized by multiplying them by a 5-year annualization factor of 0.244 based on a 7 percent discount rate.

**Table IV-7: Cost Estimates for Engineering Controls Implemented for MMUs
in Underground Coal Mines with 20-500 Employees**

Controls for Mine Size 20-500	Cost per MMU	Non- LGW MMUs	LGW MMUs	First Year Costs	First Year Costs Annualized	Annual Costs
Adjust Water Sprays	\$800					
Increase Orifice Size	\$300					
Belting for Cont. Mining Mach.	\$300					
Total	\$1,400	172		\$240,800	\$58,755	
Sprays at Transfer Pts.	\$500	59		\$29,500	\$7,198	
Exhaust Fan	\$100,000					
Initial Tubing Required	\$7,500					
Total	\$107,500	34		\$3,655,000	\$891,820	
Increase Electrical Cost	\$30,000	34				\$1,020,000
Replacement Tubing	\$750	34				\$25,500
Change Scrubber Screen Size	\$800					
Retrofit Dust Collector	\$3,000					
Total	\$3,800	25		\$95,000	\$23,180	
Purchase Bags	\$43,200	25				\$1,080,000
Cut to an Open Face	\$463,165	2				\$926,330
Adjust Water Sprays	\$2,000					
Increase Orifice Size	\$800					
Headgate Shield Deflectors	\$1,300					
Headgate Scrubber System	\$30,000					
Total	\$34,100		22	\$750,200	\$183,049	
Total First Year Costs				\$4,770,500		
Total First Year Costs Annualized					\$1,164,002	
Total Annual Costs						\$3,051,830

First year cost estimates were annualized by multiplying them by a 5-year annualization factor of 0.244 based on a 7 percent discount rate.

Underground Coal Mines with 501+ Employees

Table IV-8 shows the costs of additional engineering controls likely to be used in the underground and surface areas of underground coal mines. Table IV-9 shows the costs to mine operators for additional engineering controls likely to be used at each MMU at underground coal mines. Total cost estimates are the sum of the costs from Tables IV-8 and IV-9.

First year cost estimates (costs that occur in the first year which do not repeat every year plus the annual costs) are \$1.4 million (\$88,644 + \$4,593 from Table IV-8 and \$1.1 million + \$143,000 from Table IV-9). Annualized cost estimates (annualizing the costs in the first year over the relevant equipment lifespan plus the annual costs) are \$448,529 (\$21,629 + \$4,593 from Table IV-8 and \$279,307 + \$143,000 from Table IV-9).

**Table IV-8: Cost Estimates for Engineering Controls
Underground and on the Surface of Underground Coal Mines
with 501+ Employees**

Controls for Mine Size 501+	Cost per Mine	Mines	First Year Costs	First Year Costs Annualized	Annual Costs
Adjust Fan Blades	\$600				
Adjust Regulators	\$200				
Total	\$800	12	\$9,600	\$2,342	
Water Pressure Pumps	\$26,250	3	\$78,750	\$19,215	
Surface Area of UG. Mines		Machines or Plants			
Change Filters	\$4,593	1			\$4,593
Repair Enclosures	\$294	1	\$294	\$72	
Total First Year Costs			\$88,644		
Total First Year Costs Annualized				\$21,629	
Total Annual Costs					\$4,593

First year cost estimates were annualized by multiplying them by a 5-year annualization factor of 0.244 based on a 7 percent discount rate.

**Table IV-9: Cost Estimates for Engineering Controls for MMUs
in Underground Coal Mines with 501+ Employees**

Controls for Mine Size 501+	Cost per MMU	Non-LGW MMUs	LGW MMUs	First Year Costs	First Year Costs Annualized	Annual Costs
Adjust Water Sprays	\$800					
Increase Orifice Size	\$300					
Belting for Cont. Mining Mach.	\$300					
Total Cost	\$1,400	18		\$25,200	\$6,149	
Sprays at Transfer Pts.	\$500	15		\$7,500	\$1,830	
Exhaust Fan	\$100,000					
Initial Tubing Required	\$7,500					
Total Cost	\$107,500	4		\$430,000	\$104,920	
Increase Electrical Cost	\$35,000	4				\$140,000
Replacement Tubing	\$750	4				\$3,000
Adjust Water Sprays	\$2,000					
Increase Orifice Size	\$800					
Headgate Shield Deflectors	\$1,300					
Headgate Scrubber System	\$30,000					
Total Cost per MMU	\$34,100		20	\$682,000	\$166,408	
Total First Year Costs				\$1,144,700		
Total First Year Costs Annualized					\$279,307	
Total Annual Costs						\$143,000

First year cost estimates were annualized by multiplying them by a 5-year annualization factor of 0.244 based on a 7 percent discount rate.

Surface Coal Mine Operators

Engineering Controls Needed at Surface Coal Mines

Most surface coal mine operators will not need to implement additional engineering controls to comply with the final rule. MSHA has determined, however, that some surface coal mines will need additional engineering controls for equipment (bulldozers and front-end loaders), for plants, and in shops. The types and unit costs of engineering controls are discussed below. Table IV-10 shows cost estimates for the additional engineering controls.

Install New Cab

In the PREA, MSHA estimated that: no machines at mines with 1-19 employees, 3 machines at mines with 20-500 employees, and 1 machine at a mine with 501+ employees, would need a new cab either because the machine currently does not have a cab or because the existing cab cannot be refurbished or repaired. For this analysis, MSHA estimates that operators

will need to install a new cab for 5 machines at mines with 20-500 employees and 2 machines at a mine with 501+ employees. On average, MSHA estimates that installing a new cab on a machine costs \$8,000.

Refurbish Cab

In the PREA, MSHA estimated that: 2 machines at mines with 1-19 employees, 8 machines at mines with 20-500 employees, and 4 machines at mines with 501+ employees needed refurbished cabs. For this analysis, MSHA estimates that: 4 machines at mines with 1-19 employees; 16 machines at mines with 20-500 employees; and 8 machines at mines with 501+ employees will need refurbished cabs. Refurbishing a cab consists of installing a new interior, sealing cracks, and thoroughly cleaning the inside cab area. On average, MSHA estimates that refurbishing a cab costs \$4,000 (including labor).

Repair Cab

Repairing an existing cab consists of sealing all cracks and cleaning the cab interior. MSHA estimates that: 8 machines at mines with 1-19 employees, 24 machines at mines with 20-500 employees, and 8 machines at mines with 501+ employees will need the cab repaired. On average, MSHA estimates that it will take a surface mechanic, earning \$32.92 per hour, 1 hour to repair an existing cab.

Change Filters

The need to frequently change cabin air filters, which was discussed earlier concerning machines at surface areas of underground coal mines, also applies to machines at surface coal mines. MSHA estimates that: 10 machines in mines with 1-19 employees; 35 machines in mines with 20-500 employees; and 20 machines in mines with 501+ employees will need more frequent filter changes. Current practice on some machines is to change these filters once per month. MSHA estimates that filters will need to be changed once a week; thus, 3 additional filter changes per month will be needed. MSHA estimates that a surface mechanic takes 45 minutes (0.75 hours) to change both filters and that each filter costs \$50. MSHA estimates that the annual costs to change filters more frequently for each affected machine will be \$4,489 [3 additional filter changes per mo. x 12 mos. x ((2 filters x \$50 per filter) + (0.75 hrs. x \$32.92 hourly wage rate))].

Repair Enclosures in Plants

Engineering controls will also need to be installed in processing plants. In the PREA, MSHA estimated that operators of 4 plants in surface coal mines with 20-500 employees and 1 plant in a mine with 501+ employees would need to repair 3 enclosures per plant. For this analysis, MSHA estimates that operators of 8 plants in surface coal mines with 20-500 employees and 2 plants in a mine with 501+ employees will need to repair 3 enclosures per plant. In many cases, miners work in enclosures that are located in the plant. These enclosures protect miners from air that contain dust and other airborne particles. MSHA estimates that it takes a surface mechanic 4 hours to repair an enclosure, and that 3 enclosures need to be repaired per plant. MSHA estimates that the cost to repair 3 enclosures in a plant is \$395 (4 hrs. x \$32.92 hourly wage rate x 3 enclosures).

Portable Exhaust Fan and Tubing

The portable exhaust fan and tubing are mobile and can be placed in different areas of a plant or a shop when problems with airborne particles arise. MSHA estimates that: 1 processing

plant and 2 shops in mines with 20-500 employees; and 1 processing plant in a mine with 501+ employees, will need a portable exhaust fan and tubing to capture welding fumes and/or grinding dust. MSHA estimates that each plant or shop will need 1 portable exhaust fan and tubing costing \$1,500.

Stationary Exhaust System

In areas of a processing plant or a shop that continually have problems with airborne particles, it is better to build a stationary exhaust system for the problem area rather than purchase a portable exhaust fan. MSHA estimates that 4 shops in mines with 20-500 employees will need to construct a stationary exhaust system. MSHA estimates that it will take a welder working in a surface coal mine, earning \$35.53 per hour, an average of 8 hours to construct a stationary exhaust system. The system requires \$400 worth of sheeting material and \$300 for a motor and exhaust fan. MSHA estimates that constructing a stationary exhaust system costs \$984 [(\$400 for sheeting materials + \$300 for exhaust motor and fan + (8 hours x \$35.53 hourly wage rate)].

Cost Estimate for Engineering Controls at Surface Coal Mines, by Mine Size

Table IV-10 shows, by mine size, MSHA's estimate of the total cost for surface coal mine operators to implement engineering controls to comply with the final rule. First year cost estimates (costs that occur in the first year which do not repeat every year plus the annual costs) are \$475,000 (\$183,203 + \$291,785). Annualized cost estimates (annualizing the costs that occur in the first year over the relevant equipment lifespan plus the annual costs) are \$336,500 (\$44,701 + \$291,785).

Table IV-10: Cost Estimates for Engineering Controls in Surface Coal Mines

Controls by Mine Size	Unit Cost	Machines	Plants	Shops	First Year Costs	First Year Costs Annualized	Annual Costs
1-19 Employees							
Refurbish Cab	\$4,000	4			\$16,000	\$3,904	
Repair Cab	\$32.92	8			\$263	\$64	
Change Filters	\$4,489	10					\$44,890
Sub-total					\$16,263	\$3,968	\$44,890
20-500 Employees							
Install New Cab	\$8,000	5			\$40,000	\$9,760	
Refurbish Cab	\$4,000	16			\$64,000	\$15,616	
Repair Cab	\$32.92	24			\$790	\$193	
Change Filters	\$4,489	35					\$157,115
Repair Enclosures in Plants	\$395		8		\$3,160	\$771	
Portable Exhaust Fan & Tubing	\$1,500		1	2	\$4,500	\$1,098	
Stationary Exhaust System	\$984			4	\$3,936	\$960	
Sub-Total					\$116,386	\$28,398	\$157,115
501+ Employees							
Install New Cab	\$8,000	2			\$16,000	\$3,904	
Refurbish Cab	\$4,000	8			\$32,000	\$7,808	
Repair Cab	\$32.92	8			\$263	\$64	
Change Filters	\$4,489	20					\$89,780
Repair Enclosures in Plants	\$395		2		\$790	\$193	
Portable Exhaust Fan & Tubing	\$1,500		1		\$1,500	\$366	
Sub-Total					\$50,553	\$12,335	\$89,780
Total					\$183,203	\$44,701	\$291,785

First year cost estimates were annualized by multiplying them by a 5-year annualization factor of 0.244 based on a 7 percent discount rate.

Summary of Total Estimate of Costs for Underground and Surface Coal Mine Operators to Install Additional Engineering Controls

Table IV-11 shows, by mine size, that MSHA's cost estimates for implementing engineering controls in the first year that the final rule is in effect are \$10.7 million for underground coal mine operators and \$475,000 for surface coal mine operators (costs in the first year are the sum of the costs that occur in the first year which do not repeat every year plus the annual costs).

**Table IV-11: Cost Estimates for Engineering Controls
In the First Year**

Detail	1-19	20-500	501+	Total
Underground Coal Operators				
Cost of Implementing Engineering Controls	\$353,500	\$8,959,700	\$1,380,900	\$10,694,200
Surface Coal Operators				
Cost of Implementing Engineering Controls	\$61,200	\$273,500	\$140,400	\$475,000

First Year Costs = costs that occur in the first year which do not repeat every year plus annual costs.

Table IV-12 shows, by mine size, that MSHA's annualized cost estimates (annualizing the costs that occur in the first year which do not repeat every year plus the annual costs) for implementing engineering controls are \$5.1 million for underground coal mine operators and \$336,500 for surface coal mine operators.

Table IV-12: Annualized Cost Estimates for Engineering Controls

Detail	1-19	20-500	501+	Total
Underground Coal Operators				
Cost of Implementing Engineering Controls	\$133,300	\$4,496,800	\$448,500	\$5,078,600
Surface Coal Operators				
Cost of Implementing Engineering Controls	\$48,900	\$185,500	\$102,100	\$336,500

Annualized Costs = Annualizing the costs that occur in the first year over the relevant equipment lifespan plus annual costs.

MSHA's Estimate of Engineering Controls and Work Practices

MSHA recognizes that there may be occasions where a mine or MMU could need more or less engineering controls and work practices than the Agency's estimates above. In addition, there may be situations where an operator may choose to use a different mix of controls and practices for the mine or MMU than noted above. MSHA does not presume that only the engineering controls and work practices estimated above will be used by all operators to comply with the final rule. It could be that an operator may have a situation where engineering controls or work practices other than the above estimates could be more effective or less costly in reducing dust concentrations under the final rule. The Agency realizes that using engineering controls and work practices to implement the final rule is one of the more costly areas for operators. However, MSHA does not have the information to create probability distributions for each engineering control and work practice. For these reasons, Appendix B sets forth an uncertainty analysis for estimating these costs.

Mine Ventilation Plan: Contents, Notification, and Posting

Final § 75.371(f) and (j) revise the information required to be provided by underground coal mine operators in their mine ventilation plans. Final paragraph (f) adds a new requirement to include the minimum quantity of air that will be delivered to the working section for each MMU along with a description of each dust suppression system that includes: 1) the number, types, location, orientation, operating pressure, and flow rate of operating water sprays; 2) the maximum distance that ventilation control devices will be installed from each working face when mining or installing roof bolts in entries and crosscuts; 3) procedures for maintaining the roof bolter dust collection system in approved condition; and 4) recommended best work practices for equipment operators to minimize dust exposure. Final paragraph (j) is revised to require information on the type and size of dust collector screens used and a description of the procedures to maintain dust collectors used on equipment included in the ventilation plan. In addition, underground coal mine operators will need to revise their mine ventilation plans to include additional engineering controls that they will implement to comply with the final rule. MSHA estimates a one-time cost to make the above revisions.

All underground coal mines will need to make the revisions and submit them in writing to the District Manager under existing § 75.370(a)(2). On average, MSHA estimates that a supervisor, earning \$84.69 per hour will take 1 hour to revise the ventilation plan. On average, MSHA estimates that a clerical employee, earning \$28.67 per hour, will take 15 minutes (0.25 hours) to prepare and send the material to MSHA. The estimated costs for postage and copy are \$1.45 per revision [(3 pages on average x \$0.15 per page) + \$1 postage]. MSHA estimates that first year costs for underground coal mine operators to revise mine ventilation plans are \$39,500. Costs for each mine size are shown below:

Underground Coal Mine Operators:

- \$7,558 in mines with 1-19 employees [81 ventilation plan revisions and notifications x ((1 hr. x \$84.69 hourly wage rate) + (0.25 hrs. x \$28.67 hourly wage rate) + \$1.45)];
- \$30,885 in mines with 20-500 employees [331 ventilation plan revisions and notifications x ((1 hr. x \$84.69 hourly wage rate) + (0.25 hrs. x \$28.67 hourly wage rate) + \$1.45)]; and
- \$1,120 in mines with 501+ employees [12 ventilation plan revisions and notifications x ((1 hr. x \$84.69 hourly wage rate) + (0.25 hrs. x \$28.67 hourly wage rate) + \$1.45)].

First year cost estimates were annualized over 10 years by multiplying them by a factor of 0.142 based on a 7 percent discount rate to arrive at an annualized cost estimate of \$5,600 for underground coal mine operators.

Under existing § 75.370(a)(3)(i) and (f)(1), underground coal mine operators are required to notify the miners' representative at least 5 days prior to submission of mine ventilation plan revisions and, if requested, provide a copy of the revisions to the miners' representative. MSHA assumes that a copy of the revisions will be requested. Therefore, the number of copies equals the number of revisions noted above. MSHA estimates that a clerical employee will take 15 minutes (0.25 hours) to notify and provide a copy of the revisions to the miners' representative at the mine. MSHA estimates copying costs are \$0.45 per revision (3 pgs. x \$0.15 page). MSHA estimates that first year costs for underground coal mine operators to notify and provide a copy of revisions to mine ventilation plans are \$3,200. Costs for each mine size are shown below:

Underground Coal Mine Operators:

- \$617 in mines with 1-19 employees [81 mines revising ventilation plans x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.45)];
- \$2,521 in mines with 20-500 employees [331 mines revising ventilation plans x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.45)]; and
- \$91 in mines with 501+ employees [12 mines revising ventilation plans x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.45)].

First year cost estimates were annualized over 10 years by multiplying them by a factor of 0.142 based on a 7 percent discount rate to arrive at an annualized cost estimate of \$450 for underground coal mine operators.

Under existing § 75.370(a)(3)(iii) and (f)(3), underground coal mine operators must post a copy of the revisions of the mine ventilation plan on the mine bulletin board. The number of postings is equal to the number of revisions noted above. MSHA estimates that it takes a clerical employee 15 minutes (0.25 hours) to post a copy of the revisions to the mine ventilation plan. Estimates for copy costs are \$0.45 per revision (3 pgs. x \$0.15 page). MSHA estimates that first year costs for underground coal mine operators to post a copy of revisions to mine ventilation plans are \$3,200. Costs for each mine size are shown below:

Underground Coal Mine Operators:

- \$617 in mines with 1-19 employees [81 postings x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.45)];
- \$2,521 in mines with 20-500 employees [331 postings x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.45)]; and
- \$91 in mines with 501+ employees [12 postings x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.45)].

First year cost estimates were annualized over 10 years by multiplying them by a factor of 0.142 based on a 7 percent discount rate to arrive at an annualized cost estimate of \$450 for underground coal mine operators.

Table IV-13 shows for underground coal mine operators, by mine size, a summary of the first year cost estimates with mine ventilation plan changes required by final § 75.371.

**Table IV-13: First Year Cost Estimates Associated with
Mine Ventilation Plan Changes
for Underground Coal Mine Operators**

Description	Underground Coal Mines			
	(1-19)	(20-500)	(501+)	Total
Make Mine Ventilation Plan Changes	\$7,558	\$30,885	\$1,120	\$39,562
Notify Miners' Rep.	\$617	\$2,521	\$91	\$3,230
Post Mine Ventilation Plan Changes	\$617	\$2,521	\$91	\$3,230
Total	\$8,792	\$35,928	\$1,303	\$46,022

Table IV-14 shows for underground coal mine operators, by mine size, a summary of the annualized cost estimates that are associated with mine ventilation plan changes required by final § 75.371.

**Table IV-14: Annualized Cost Estimates Associated with
Mine Ventilation Plan Changes
for Underground Coal Mine Operators**

Description	Underground Coal Mines			
	(1-19)	(20-500)	(501+)	Total
Make Mine Ventilation Plan Changes	\$1,073	\$4,386	\$159	\$5,618
Notify Miners' Rep.	\$88	\$358	\$13	\$459
Post Mine Ventilation Plan Changes	\$88	\$358	\$13	\$459
Total	\$1,248	\$5,102	\$185	\$6,535

Abatement Cost Estimates

MSHA expects that operators will install additional engineering controls to comply with the final rule. During the first few years that the final rule is in effect, operators will make adjustments to these engineering controls as they become more familiar with the controls and the resulting dust levels. During this transition period, MSHA expects that operators will receive more citations for respirable coal mine dust overexposures than under the existing standards.

Under final §§ 70.206(f)(1) and (f)(2); 70.207(e)(1) and (e)(2); 70.208(f)(1) and (f)(2); 70.209(d)(1) and (d)(2); 71.206(i)(1) and (i)(2); 72.800; and 90.207(d)(1) and (d)(2), an operator will receive a citation if an MSHA inspector single, full-shift sample, multiple operator full-shift samples, or the average of multiple operator full-shift samples, meets or exceeds the ECV. An ECV is the excessive concentration measurement demonstrating that the applicable dust standard has been exceeded at a confidence level of at least 95 percent.

Under final §§ 70.206(h) and (i), 70.207(g) and (h), 70.208(h) and (i), 70.209(f), 71.206(k), 71.300(a), 72.800, 90.207(f), and 90.300(a), whenever an operator receives a citation for violating the respirable dust standard, several provisions are triggered. The operator will need to take corrective action to address the problem and record the action taken. After taking corrective action, the operator will be required to sample thereby assuring that the problem has been corrected and that dust concentrations comply with the applicable standard. The operator may make revisions to the mine ventilation plan or develop or revise a dust control plan, whichever applies.

To estimate the costs associated with the operator abating a citation, MSHA estimated the number of times samples will meet or exceed the ECV and the number of times the average of operator samples meets or exceeds the ECV. Appendix A provides the analysis of how MSHA projected the number of citations expected under the final rule. The data in Appendix A was adjusted to account for the following.

- Final §§ 70.201(c), 71.201(b) and 90.201(b) require that sampling devices be worn from portal to portal during the entire length of each sampled shift. In 2009, operator sampling was for 8 hours or less, even if the miner worked for more than an 8-hour shift. MSHA adjusted the underground sampling results to account for full-shift sampling.
- Final § 70.2 defines normal production shift for underground coal mines as a production shift during which the amount of material produced by an MMU is at least equal to 80 percent of the average production recorded by the operator (1) for the most recent 30 production shifts, or (2) for all production shifts if fewer than 30 shifts of production data are available. The 2009 sampling results reflect only production levels that were at least 50 percent of the average production reported for the last set of five valid samples. With all else being equal, higher production levels result in higher exposure levels, so MSHA also adjusted the underground sampling results to account for higher production.
- Under the final rule, noncompliance determinations for operator sampling vary depending on where and how the sample is collected. Noncompliance determinations related to operator full-shift sample results will be based on either (1) averaging all samples collected in a sampling period, or (2) when 2 out of 5 samples meet or exceed the ECV in a sampling period, or 3 out of 15 samples meet or exceed the ECV in a sampling period.
- Under final § 72.800, operators will be issued citations when an MSHA inspector single, full-shift sample meets or exceeds the applicable ECV.
- Under the final rule, all surface coal mine operators are required to take respirable dust samples. Currently, surface coal mine operators are required to sample only when MSHA has identified a designated work position that meets specific criteria, or MSHA has issued a citation for violating the respirable dust standard.

Estimate of the Number of Additional Citations

The number of estimated additional citations resulting from noncompliance determinations for underground and surface coal mine operators is shown below. The estimated

additional citations decrease from the first year to the second year, increase in the third year, and then decrease in years four and five. Under the final rule, the existing respirable coal mine dust standard of 2.0 mg/m³ remains in effect the first two years (24 months). Twenty-four months after the effective date of the final rule, the standard will be 1.5 mg/m³. MSHA expects operators to install additional engineering controls during the first year of the final rule. As operators gain experience with these changes, the Agency expects that the additional citations in the second year will be lower than the first year since there is no change in the respirable dust standard. However, when the respirable coal mine dust standard is reduced in the third year to 1.5 mg/m³, MSHA expects additional citations to increase in the third year. As operators gain experience operating under the lower respirable coal mine dust standard and with the additional engineering controls that have been installed, MSHA expects the number of citations to decrease after the third year until the fifth year, after which it remains constant. Costs estimated below reflect changes in the estimated number of additional citations.

Underground Coal Mine Operators

For underground coal mine operators, Table IV-15 shows MSHA's estimates of the additional citations expected as a result of the final rule. Table A-17 in Appendix A of this REA is the source for the numbers in Table IV-15.

**Table IV-15: Number of Additional Citations
for Underground Coal Mine Operators
Resulting from the Final Rule**

Mine Size	Year 1	Year 2	Year 3	Year 4	Year 5 and Every Year Thereafter
1-19	63	45	66	27	19
20-500	529	359	584	208	125
501+	83	63	121	47	33
Total	675	467	771	282	177

Surface Coal Mine Operators

For surface coal mine operators, Table IV-16 shows MSHA's estimates of the additional citations expected as a result of the final rule. Table A-20 in Appendix A of this REA is the source for the numbers in Table IV-16.

**Table IV-16: Number of Additional Citations
for Surface Coal Mine Operators
Resulting from the Final Rule**

Mine Size	Year 1	Year 2	Year 3	Year 4	Year 5 and Every Year Thereafter
1-19	21	13	16	9	8
20-500	17	10	13	7	7
501+	4	2	3	2	1
Total	42	25	32	18	16

Abatement Cost Estimates Resulting from the Final Rule

MSHA's estimate of the costs to abate citations is presented below. The abatement costs consist of several items including, but not limited to, taking corrective actions and recording them, conducting abatement sampling, and modifying the mine ventilation plan or developing or revising the dust control plan, whichever is applicable. After deriving these abatement costs, MSHA then calculates the penalties resulting from the additional citations. MSHA does not consider penalties to be a cost of the rule because the Agency considers them to be transfer payments. However, MSHA calculated the penalties because the Agency adds them to the costs of the rule when determinations are made on the economic feasibility of the rule and on small business impacts.

Use of the CPDM is not required until 18 months after the effective date of the final rule for most sampling in underground coal mines, and only for part 90 sampling at surface coal mines. Therefore, the costs for abating a citation during the first 18 months are associated with using the gravimetric sampler. The costs for abating a citation after 18 months are associated primarily with using the CPDM in underground coal mines, and primarily with using the gravimetric sampler in surface coal mines.

Implement Corrective Actions

Before conducting abatement sampling, operators will need to implement corrective actions under final §§ 70.206(h)(2), 70.207(g)(2), 70.208(h)(2), and 70.209(f)(2) at underground coal mines; 71.206(k)(2) at surface coal mines; and 90.207(f)(2) for part 90 miners. MSHA assumes that both underground and surface coal mine operators will adjust existing controls. In underground coal mines, these corrective actions could consist of: adjusting regulators and then taking readings; adjusting the type, flow rate and/or pressure of water sprays; and changing sprays to increase the flow rate. In surface coal mines, the corrective actions could consist of cleaning or repairing cabs and changing filters more frequently.

In the PREA, MSHA estimated that, on average, the cost (including labor) for implementing a corrective action was \$1,000 in an underground coal mine and \$500 in a surface coal mine. The proposed rule would have required the respirable coal mine dust standard to be reduced from the existing 2.0 mg/m³ standard to 1.0 mg/m³. The final rule establishes a 1.5 mg/m³ standard. MSHA believes that the corrective actions necessary under the final rule will be less costly than those projected under the proposed rule. MSHA revises its estimate for the average cost (including labor) to implement a corrective action to \$250 in underground and surface coal mines.

Underground Coal Mine Operators

First Year of the Final Rule

MSHA estimates that the costs to implement corrective actions in the first year that the final rule is in effect are \$168,750 for underground coal mine operators. Costs for each mine size are shown below:

- \$15,750 in mines with 1-19 employees (63 corrective actions x \$250);
- \$132,250 in mines with 20-500 employees (529 corrective actions x \$250); and
- \$20,750 in mines with 501+ employees (83 corrective actions x \$250).

Second Year of the Final Rule

MSHA estimates that the costs to implement corrective actions in the second year that the final rule is in effect are \$116,750 for underground coal mine operators. Costs for each mine size are shown below:

- \$11,250 in mines with 1-19 employees (45 corrective actions x \$250);
- \$89,750 in mines with 20-500 employees (359 corrective actions x \$250); and
- \$15,750 in mines with 501+ employees (63 corrective actions x \$250).

Third Year of the Final Rule

MSHA estimates that the costs to implement corrective actions in the third year that the final rule is in effect are \$192,750 for underground coal mine operators. Costs for each mine size are shown below:

- \$16,500 in mines with 1-19 employees (66 corrective actions x \$250);
- \$146,000 in mines with 20-500 employees (584 corrective actions x \$250); and
- \$30,250 in mines with 501+ employees (121 corrective actions x \$250).

Fourth Year of the Final Rule

MSHA estimates that the costs to implement corrective actions in the fourth year that the final rule is in effect are \$70,500 for underground coal mine operators. Costs for each mine size are shown below:

- \$6,750 in mines with 1-19 employees (27 corrective actions x \$250);
- \$52,000 in mines with 20-500 employees (208 corrective actions x \$250); and
- \$11,750 in mines with 501+ employees (47 corrective actions x \$250).

Fifth Year of the Final Rule and Every Year Thereafter

MSHA estimates that the costs to implement corrective actions in the fifth year, and every year thereafter, that the final rule is in effect are \$44,250 for underground coal mine operators. Costs for each mine size are shown below:

- \$4,750 in mines with 1-19 employees (19 corrective actions x \$250);
- \$31,250 in mines with 20-500 employees (125 corrective actions x \$250); and
- \$8,250 in mines with 501+ employees (33 corrective actions x \$250).

Under the final rule, the cost of implementing corrective actions in underground coal mines changes each year until the fifth year, after which it remains constant. The Agency estimated costs that will be incurred over a 10-year period by multiplying each year's costs (excluding the costs in the first year) by a discount factor. MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at annual cost estimates of: \$9,181 for mines with 1-19 employees; \$72,074 for mines with 20-500 employees; and \$14,705 for mines with 501+ employees.

Surface Coal Mine Operators

First Year of the Final Rule

MSHA estimates that the costs to implement corrective actions in the first year that the

final rule is in effect are \$10,500 for surface coal mine operators. Costs for each mine size are shown below:

- \$5,250 in mines with 1-19 employees (21 corrective actions x \$250);
- \$4,250 in mines with 20-500 employees (17 corrective actions x \$250); and
- \$1,000 in mines with 501+ employees (4 corrective actions x \$250).

Second Year of the Final Rule

MSHA estimates that the costs to implement corrective actions in the second year that the final rule is in effect are \$6,250 for surface coal mine operators. Costs for each mine size are shown below:

- \$3,250 in mines with 1-19 employees (13 corrective actions x \$250);
- \$2,500 in mines with 20-500 employees (10 corrective actions x \$250); and
- \$500 in mines with 501+ employees (2 corrective actions x \$250).

Third Year of the Final Rule

MSHA estimates that the costs to implement corrective actions in the third year that the final rule is in effect are \$8,000 for surface coal mine operators. Costs for each mine size are shown below:

- \$4,000 in mines with 1-19 employees (16 corrective actions x \$250);
- \$3,250 in mines with 20-500 employees (13 corrective actions x \$250); and
- \$750 in mines with 501+ employees (3 corrective actions x \$250).

Fourth Year of the Final Rule

MSHA estimates that the costs to implement corrective actions in the fourth year that the final rule is in effect are \$4,500 for surface coal mine operators. Costs for each mine size are shown below:

- \$2,250 in mines with 1-19 employees (9 corrective actions x \$250);
- \$1,750 in mines with 20-500 employees (7 corrective actions x \$250); and
- \$500 in mines with 501+ employees (2 corrective actions x \$250).

Fifth Year of the Final Rule and Every Year Thereafter

MSHA estimates that the costs to implement corrective actions in the fifth year, and every year thereafter, that the final rule is in effect are \$4,000 for surface coal mine operators. Costs for each mine size are shown below:

- \$2,000 in mines with 1-19 employees (8 corrective actions x \$250);
- \$1,750 in mines with 20-500 employees (7 corrective actions x \$250); and
- \$250 in mines with 501+ employees (1 corrective action x \$250).

Under the final rule, the cost of implementing corrective actions in surface coal mines changes each year until the fifth year, after which it remains constant. The Agency estimated costs that will be incurred over a 10-year period by multiplying each year's costs (excluding the costs in the first year) by a discount factor. MSHA then annualized these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount

rate to arrive at annual cost estimates of: \$3,038 for mines with 1-19 employees; \$2,508 for mines with 20-500 employees; and \$497 for mines with 501+ employees.

Record and Certify Corrective Actions

A record of corrective actions must be made and certified under final §§ 70.206(h)(3), 70.207(g)(3), 70.208(h)(3), 70.209(f)(3) at underground coal mines; 71.206(k)(3) at surface coal mines; and 90.207(f)(3) for part 90 miners. MSHA estimates that, on average, it takes 12 minutes (0.2 hours) to make a record of corrective actions and certify the record. MSHA assumes that a supervisor, earning \$84.69 per hour in an underground coal mine and \$71.18 per hour in a surface coal mine, makes the record. In addition, MSHA assumes that a mine foreman or equivalent mine official who certifies the record also earns the supervisory hourly wage rate.

Underground Coal Mine Operators

First Year of the Final Rule

MSHA estimates that the costs to record and certify corrective actions in the first year that the final rule is in effect are \$11,450 for underground coal mine operators. Costs for each mine size are shown below:

- \$1,067 in mines with 1-19 employees (63 records x 0.2 hrs. x \$84.69 hourly wage rate);
- \$8,960 in mines with 20-500 employees (529 records x 0.2 hrs. x \$84.69 hourly wage rate); and
- \$1,406 in mines with 501+ employees (83 records x 0.2 hrs. x \$84.69 hourly wage rate).

Second Year of the Final Rule

MSHA estimates that the costs to record and certify corrective actions in the second year that the final rule is in effect are \$7,925 for underground coal mine operators. Costs for each mine size are shown below:

- \$762 in mines with 1-19 employees (45 records x 0.2 hrs. x \$84.69 hourly wage rate);
- \$6,081 in mines with 20-500 employees (359 records x 0.2 hrs. x \$84.69 hourly wage rate); and
- \$1,067 in mines with 501+ employees (63 records x 0.2 hrs. x \$84.69 hourly wage rate).

Third Year of the Final Rule

MSHA estimates that the costs to record and certify corrective actions in the third year that the final rule is in effect are \$13,075 for underground coal mine operators. Costs for each mine size are shown below:

- \$1,118 in mines with 1-19 employees (66 records x 0.2 hrs. x \$84.69 hourly wage rate);
- \$9,892 in mines with 20-500 employees (584 records x 0.2 hrs. x \$84.69 hourly wage rate); and
- \$2,049 in mines with 501+ employees (121 records x 0.2 hrs. x \$84.69 hourly wage rate).

Fourth Year of the Final Rule

MSHA estimates that the costs to record and certify corrective actions in the fourth year that the final rule is in effect are \$4,800 for underground coal mine operators. Costs for each mine size are shown below:

- \$457 in mines with 1-19 employees (27 records x 0.2 hrs. x \$84.69 hourly wage rate);
- \$3,523 in mines with 20-500 employees (208 records x 0.2 hrs. x \$84.69 hourly wage rate); and
- \$796 in mines with 501+ employees (47 records x 0.2 hrs. x \$84.69 hourly wage rate).

Fifth Year of the Final Rule and Every Year Thereafter

MSHA estimates that the costs to record and certify corrective actions in the fifth year, and every year thereafter that the final rule is in effect, are \$3,000 for underground coal mine operators. Costs for each mine size are shown below:

- \$322 in mines with 1-19 employees (19 records x 0.2 hrs. x \$84.69 hourly wage rate);
- \$2,117 in mines with 20-500 employees (125 records x 0.2 hrs. x \$84.69 hourly wage rate); and
- \$559 in mines with 501+ employees (33 records x 0.2 hrs. x \$84.69 hourly wage rate).

Under the final rule, the cost to record and certify corrective actions in underground coal mines changes each year until the fifth year, after which it remains constant. The Agency estimated costs that will be incurred over a 10-year period by multiplying each year's costs (excluding the costs in the first year) by a discount factor. MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at annual cost estimates of: \$622 for mines with 1-19 employees; \$4,883 for mines with 20-500 employees; and \$996 for mines with 501+ employees.

Surface Coal Mine Operators

First Year of the Final Rule

MSHA estimates that the costs to record and certify corrective actions in the first year that the final rule is in effect are \$600 for surface coal mine operators. Costs for each mine size are shown below:

- \$299 in mines with 1-19 employees (21 records x 0.2 hrs. x \$71.18 hourly wage rate);
- \$242 in mines with 20-500 employees (17 records x 0.2 hrs. x \$71.18 hourly wage rate); and
- \$57 in mines with 501+ employees (4 records x 0.2 hrs. x \$71.18 hourly wage rate).

Second Year of the Final Rule

MSHA estimates that the costs to record and certify corrective actions in the second year that the final rule is in effect are \$375 for surface coal mine operators. Costs for each mine size are shown below:

- \$185 in mines with 1-19 employees (13 records x 0.2 hrs. x \$71.18 hourly wage rate);

- \$142 in mines with 20-500 employees (10 records x 0.2 hrs. x \$71.18 hourly wage rate); and
- \$28 in mines with 501+ employees (2 records x 0.2 hrs. x \$71.18 hourly wage rate).

Third Year of the Final Rule

MSHA estimates that the costs to record and certify corrective actions in the third year that the final rule is in effect are \$475 for surface coal mine operators. Costs for each mine size are shown below:

- \$228 in mines with 1-19 employees (16 records x 0.2 hrs. x \$71.18 hourly wage rate);
- \$185 in mines with 20-500 employees (13 records x 0.2 hrs. x \$71.18 hourly wage rate); and
- \$43 in mines with 501+ employees (3 records x 0.2 hrs. x \$71.18 hourly wage rate).

Fourth Year of the Final Rule

MSHA estimates that the costs to record and certify corrective actions in the fourth year that the final rule is in effect are \$275 for surface coal mine operators. Costs for each mine size are shown below:

- \$128 in mines with 1-19 employees (9 records x 0.2 hrs. x \$71.18 hourly wage rate);
- \$100 in mines with 20-500 employees (7 records x 0.2 hrs. x \$71.18 hourly wage rate); and
- \$28 in mines with 501+ employees (2 records x 0.2 hrs. x \$71.18 hourly wage rate).

Fifth Year of the Final Rule and Every Year Thereafter

MSHA estimates that the costs to record and certify corrective actions in the fifth year, and every year thereafter that the final rule is in effect, are \$250 for surface coal mine operators. Costs for each mine size are shown below:

- \$114 in mines with 1-19 employees (8 records x 0.2 hrs. x \$71.18 hourly wage rate);
- \$100 in mines with 20-500 employees (7 records x 0.2 hrs. x \$71.18 hourly wage rate); and
- \$14 in mines with 501+ employees (1 record x 0.2 hrs. x \$71.18 hourly wage rate).

Under the final rule, the cost to record and certify corrective actions in surface coal mines changes each year until the fifth year, after which it remains constant. The Agency estimated costs that will be incurred over a 10-year period by multiplying each year's costs (excluding the costs in the first year) by a discount factor. MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at annual cost estimates of: \$173 for mines with 1-19 employees; \$143 for mines with 20-500 employees; and \$28 for mines with 501+ employees.

Conduct Abatement Sampling

After corrective actions have been implemented operators must conduct abatement sampling under final §§ 70.206(h)(4), 70.207(g)(4), 70.208(h)(4), and 70.209(f)(4) at underground coal mines; 71.206(k)(4) at surface coal mines; and 90.207(f)(2)(i) for part 90 miners.

Cost per Abatement Sample in the First Year of the Final Rule

For the first year of the final rule both underground and surface coal mine operators will use the gravimetric sampler to conduct sampling. Therefore, for the first year of the final rule, MSHA based the additional abatement sampling costs for underground and surface coal mines on the costs to use a gravimetric sampler. On average, MSHA estimates that it takes 1 hour to prepare the gravimetric sampler and perform the required checks during sampling. This time includes 50 minutes (0.8333 hours) of a certified dust technician's time to prepare, disassemble, and clean the sampling unit after completion of sampling. In addition, MSHA estimates that it takes a mine supervisor 10 minutes (0.1666 hours) to make the required operational checks of the sampling device during the shift. Five samples are taken each time abatement sampling is conducted with the gravimetric sampler.

MSHA estimates that in an underground coal mine, a certified dust technician's wage is \$33.23 per hour, and a supervisor's wage is \$84.69 per hour. The cost for each filter for a gravimetric sampler is \$19.89. Also with each sample taken, a control filter is needed, costing an additional \$19.89. MSHA estimates that the cost to take a sample using a gravimetric sampler in an underground coal mine is \$81.58 ($\$33.23 \text{ per hr.} \times 0.8333 \text{ hrs.} + \$84.69 \text{ per hr.} \times 0.1666 \text{ hrs.} + \$19.89 \text{ per filter} + \$19.89 \text{ per control filter}$). MSHA estimates that in a surface coal mine, a certified dust technician's wage is \$28.13 per hour, and a supervisor's wage is \$71.18 per hour. The cost for each filter for a gravimetric sampler is \$19.89. Also with each sample taken, a control filter is needed, costing an additional \$19.89. MSHA estimates that the cost to take a sample using a gravimetric sampler in a surface coal mine is \$75.08 ($\$28.13 \text{ per hr.} \times 0.8333 \text{ hrs.} + \$71.18 \text{ per hr.} \times 0.1666 \text{ hrs.} + \$19.89 \text{ per filter} + \$19.89 \text{ per control filter}$).

Cost per Abatement Sample in the Second Year of the Final Rule

During the first half of the second year that the final rule is in effect, underground coal mine operators will use the gravimetric sampler to take abatement samples. During the remaining half of the second year, they will primarily be sampling with the CPDM. MSHA estimates that the cost for conducting abatement sampling with a CPDM is \$28.92 per sample. This cost is comprised of: using a new CPDM filter (costing \$6.50) each time sampling is conducted; \$14.11 for operational checks during the shift (0.1666 hours for operational checks during shift \times \$84.69 hourly wage rate); and performing before shift maintenance costing \$8.31 (0.25 hours \times \$33.23 certified person hourly wage rate). Based on the manufacturer's recommendations, the Tapered Element Oscillating Microbalance (TEOM®) filter must be replaced; and the grit pot, mass transducer area, and sample lines must be cleaned after the CPDM has been used on a shift and before it can be used again. In addition, the CPDM has to be programmed before each shift on which it is used. MSHA estimates that it takes 15 minutes (0.25 hours) to perform the above tasks.

For underground coal mine operators, in the second year that the final rule is in effect, the gravimetric sampler is used for abatement sampling during the first 3 bimonthly sampling periods, while the CPDM is used primarily for abatement sampling during the remaining 2 quarters in the second year. MSHA apportioned the costs for taking an abatement sample in the second year of the rule between the two samplers. MSHA estimates that in the second year that the final rule is in effect, the cost to take an abatement sample in an underground coal mine is \$60.52 [$(\$81.58 \text{ to take a sample using a gravimetric sampler} \times 60 \text{ percent}) + (\$28.92 \text{ to take a sample using the CPDM} \times 40 \text{ percent})$].

Surface coal mine operators are required to use the CPDM in the second half of the year to conduct part 90 sampling. Most of the sampling under the final rule in surface coal mines will be for Designated Work Positions (DWP) and will still be conducted with the gravimetric sampler. In addition, very few, if any, citations are expected for part 90 miners being overexposed at surface coal mines. For surface coal mines, MSHA estimates that abatement sampling for the second year that the final rule is in effect will be conducted primarily with the gravimetric sampler.

Cost per Abatement Sample in the Third Year of the Final Rule and Every Year Thereafter

In the third year that the final rule is in effect, and every year thereafter, MSHA expects mine operators to use the CPDM for most sampling in underground coal mines and MSHA estimates that the cost to take an abatement sample is \$28.92. For surface coal mine operators, in the third year of the final rule and every year thereafter, most abatement sampling will be for DWP; MSHA expects this sampling will be conducted using the gravimetric sampler.

The unit costs shown above are used below to develop sampling costs to abate citations. The information is presented by year.

Underground Coal Mine Operators

First Year of the Final Rule

MSHA estimates that the costs to conduct abatement sampling in the first year that the final rule is in effect are \$275,350 for underground coal mine operators. Costs for each mine size are shown below:

- \$25,698 in mines with 1-19 employees (63 citations x 5 samples x \$81.58 cost to sample);
- \$215,779 in mines with 20-500 employees (529 citations x 5 samples x \$81.58 cost to sample); and
- \$33,856 in mines with 501+ employees (83 citations x 5 samples x \$81.58 cost to sample).

Second Year of the Final Rule

MSHA estimates that the costs to conduct abatement sampling in the second year that the final rule is in effect are \$141,325 for underground coal mine operators. Costs for each mine size are shown below:

- \$13,617 in mines with 1-19 employees (45 citations x 5 samples x \$60.52 cost to sample);
- \$108,633 in mines with 20-500 employees (359 citations x 5 samples x \$60.52 cost to sample); and
- \$19,064 in mines with 501+ employees (63 citations x 5 samples x \$60.52 cost to sample).

Third Year of the Final Rule

MSHA estimates that the costs to conduct abatement sampling in the third year that the final rule is in effect are \$111,500 for underground coal mine operators. Costs for each mine size are shown below:

- \$9,544 in mines with 1-19 employees (66 citations x 5 samples x \$28.92 cost to sample);
- \$84,446 in mines with 20-500 employees (584 citations x 5 samples x \$28.92 cost to sample); and
- \$17,497 in mines with 501+ employees (121 citations x 5 samples x \$28.92 cost to sample).

Fourth Year of the Final Rule

MSHA estimates that the costs to conduct abatement sampling in the fourth year that the final rule is in effect are \$40,800 for underground coal mine operators. Costs for each mine size are shown below:

- \$3,904 in mines with 1-19 employees (27 citations x 5 samples x \$28.92 cost to sample);
- \$30,077 in mines with 20-500 employees (208 citations x 5 samples x \$28.92 cost to sample); and
- \$6,796 in mines with 501+ employees (47 citations x 5 samples x \$28.92 cost to sample).

Fifth Year of the Final Rule and Every Year Thereafter

MSHA estimates that the costs to conduct abatement sampling in the fifth year, and every year thereafter, that the final rule is in effect are \$25,600 for underground coal mine operators. Costs for each mine size are shown below:

- \$2,747 in mines with 1-19 employees (19 citations x 5 samples x \$28.92 cost to sample);
- \$18,075 in mines with 20-500 employees (125 citations x 5 samples x \$28.92 cost to sample); and
- \$4,772 in mines with 501+ employees (33 citations x 5 samples x \$28.92 cost to sample).

Under the final rule, the cost to conduct abatement sampling in underground coal mines changes each year until the fifth year, after which it remains constant. The Agency estimated costs that will be incurred over a 10-year period by multiplying each year's costs (excluding the costs in the first year) by a discount factor. MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at annual cost estimates of: \$8,609 for mines with 1-19 employees; \$68,989 for mines with 20-500 employees; and \$12,929 for mines with 501+ employees.

Surface Coal Mine Operators

First Year of the Final Rule

MSHA estimates that the costs to conduct abatement sampling in the first year that the final rule is in effect are \$15,775 for surface coal mine operators. Costs for each mine size are shown below:

- \$7,883 in mines with 1-19 employees (21 citations x 5 samples x \$75.08 cost to sample);

- \$6,382 in mines with 20-500 employees (17 citations x 5 samples x \$75.08 cost to sample); and
- \$1,502 in mines with 501+ employees (4 citations x 5 samples x \$75.08 cost to sample).

Second Year of the Final Rule

MSHA estimates that the costs to conduct abatement sampling in the second year that the final rule is in effect are \$9,400 for surface coal mine operators. Costs for each mine size are shown below:

- \$4,880 in mines with 1-19 employees (13 citations x 5 samples x \$75.08 cost to sample);
- \$3,754 in mines with 20-500 employees (10 citations x 5 samples x \$75.08 cost to sample); and
- \$751 in mines with 501+ employees (2 citations x 5 samples x \$75.08 cost to sample).

Third Year of the Final Rule

MSHA estimates that the costs to conduct abatement sampling in the third year that the final rule is in effect are \$12,025 for surface coal mine operators. Costs for each mine size are shown below:

- \$6,006 in mines with 1-19 employees (16 citations x 5 samples x \$75.08 cost to sample);
- \$4,880 in mines with 20-500 employees (13 citations x 5 samples x \$75.08 cost to sample); and
- \$1,126 in mines with 501+ employees (3 citations x 5 samples x \$75.08 cost to sample).

Fourth Year of the Final Rule

MSHA estimates that the costs to conduct abatement sampling in the fourth year that the final rule is in effect are \$6,775 for surface coal mine operators. Costs for each mine size are shown below:

- \$3,379 in mines with 1-19 employees (9 citations x 5 samples x \$75.08 cost to sample);
- \$2,628 in mines with 20-500 employees (7 citations x 5 samples x \$75.08 cost to sample); and
- \$751 in mines with 501+ employees (2 citations x 5 samples x \$75.08 cost to sample).

Fifth Year of the Final Rule and Every Year Thereafter

MSHA estimates that the costs to conduct abatement sampling in the fifth year, and every year thereafter, that the final rule is in effect are \$6,025 for surface coal mine operators. Costs for each mine size are shown below:

- \$3,003 in mines with 1-19 employees (8 citations x 5 samples x \$75.08 cost to sample);

- \$2,628 in mines with 20-500 employees (7 citations x 5 samples x \$75.08 cost to sample); and
- \$375 in mines with 501+ employees (1 citation x 5 samples x \$75.08 cost to sample).

Under the final rule, the cost to conduct abatement sampling in surface coal mines changes each year until the fifth year, after which it remains constant. The Agency estimated costs that will be incurred over a 10-year period by multiplying each year's costs (excluding the costs in the first year) by a discount factor. MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at annual cost estimates of: \$4,562 for mines with 1-19 employees; \$3,765 for mines with 20-500 employees; and \$747 for mines with 501+ employees.

Complete and Sign Dust Data Card and Send Card with Sample to MSHA

Under final §§ 70.210(a) and (c) for underground coal mine operators; 71.207(a) and (c) for surface coal mines; and 90.208(a) and (c) for part 90 miners, operators must submit abatement samples, control filters, and Dust Data Cards to MSHA. Each citation requires five operator abatement samples to be taken.

In the first year that the final rule is in effect, underground and surface coal mine operators will conduct abatement sampling with the gravimetric sampler. In the second year that the final rule is in effect, MSHA assumes that: underground coal mine operators will take abatement samples with the gravimetric sampler for half of the citations while the remaining half will be taken with the CPDM; surface coal mine operator will take abatement samples with the gravimetric sampler. In the third year that the final rule is in effect, and for every year thereafter, underground coal mine operators will take abatement samples with the CPDM, and surface coal mine operators will take abatement samples with the gravimetric sampler.

Submitting Abatement Samples When Using a Gravimetric Sampler

When abatement sampling is conducted with the gravimetric sampler, the sample must be mailed along with a completed dust card, to MSHA. The costs for submitting a sample are as follows. MSHA estimates that the person completing the Dust Data Card is a certified technician earning \$33.23 per hour in an underground coal mine and \$28.13 per hour in a surface coal mine. MSHA estimates that, on average, a certified dust technician will take 6 minutes (0.1 hours) to complete the Dust Data Card and sending it along with the sample to MSHA. MSHA estimates that, on average, a certified person earning \$84.69 per hour in an underground coal mine and \$71.18 per hour in a surface coal mine takes 1.5 minutes (0.025 hours) to review and sign the Dust Data Card and include a miner's MSHA Individual Identification Number (MIIN).

Submitting Abatement Samples When using the CPDM

When conducting abatement sampling with the CPDM, the sample is transmitted electronically and no mailing occurs. MSHA estimates that validating, certifying, and uploading the abatement sampling data from the CPDM to a computer and then transmitting the data electronically to MSHA takes a designated mine official, earning a supervisor's hourly wage of \$84.69, 6 minutes (0.1 hours).

Costs for Submitting Samples

For each citation issued, 5 operator abatement samples must be taken. Thus, the number of Dust Data Cards that must be completed and signed and sent to MSHA along with the samples will be equal to the number of citations multiplied by five. Since, paragraph (a) of final §§ 70.210, 71.207 and 90.208 also requires that the operator transmit all samples collected within 24 hours after the end of the sampled shift. MSHA makes the following assumptions. Mines with 20-500 employees and mines with 501+ employees will submit two samples per mailing since these mines on average operate two shifts per day. Mines with 1-19 employees will submit one sample per mailing since these mines mainly operate one shift per day. The cost per mailing is estimated to be \$1.

Underground Coal Mine Operators

First Year of the Final Rule

MSHA estimates that the costs to complete, sign, and send Dust Data Cards, along with abatement samples, to MSHA in the first year that the final rule is in effect are \$20,225 for underground coal mine operators. Costs for each mine size are shown below:

- \$2,029 in mines with 1-19 employees [(63 citations x 5 samples x ((0.1 hrs. x \$33.23 hourly wage rate) + (0.025 hrs. x \$84.69 hourly wage rate))) + [63 citations x 5 samples x \$1];
- \$15,712 in mines with 20-500 employees [(529 citations x 5 samples x ((0.1 hrs. x \$33.23 hourly wage rate) + (0.025 hrs. x \$84.69 hourly wage rate))) + (((529 citations x 5 samples) / 2) x \$1]; and
- \$2,465 in mines with 501+ employees [(83 citations x 5 samples x ((0.1 hrs. x \$33.23 hourly wage rate) + (0.025 hrs. x \$84.69 hourly wage rate))) + [(83 citations x 5 samples) / 2) x \$1].

Second Year of the Final Rule

First Half of Second Year

In the first half of the second year, abatement sampling will be conducted as it was conducted in the first year. MSHA estimates that the costs to complete, sign, and send Dust Data Cards, along with abatement samples, to MSHA in the first half of the second year that the final rule is in effect are \$7,050 for underground coal mine operators. Costs for each mine size are shown below:

- \$741 in mines with 1-19 employees [(23 citations x 5 samples x ((0.1 hrs. x \$33.23 hourly wage rate) + (0.025 hrs. x \$84.69 hourly wage rate))) + [23 citations x 5 samples x \$1];
- \$5,346 in mines with 20-500 employees [(180 citations x 5 samples x ((0.1 hrs. x \$33.23 hourly wage rate) + (0.025 hrs. x \$84.69 hourly wage rate))) + (((180 citations x 5 samples) / 2) x \$1]; and
- \$950 in mines with 501+ employees [(32 citations x 5 samples x ((0.1 hrs. x \$33.23 hourly wage rate) + (0.025 hrs. x \$84.69 hourly wage rate))) + (((32 citations x 5 samples) / 2) x \$1].

Remaining Half of Second Year

In the second half of the second year, and for every year thereafter, underground coal

mine operators will start to use the CPDM to conduct abatement sampling. MSHA estimates that the costs to complete, sign, and transmit abatement sampling data to MSHA in the remaining half of the second year that the final rule is in effect are \$9,825 for underground coal mine operators. Costs for each mine size are shown below:

- \$932 in mines with 1-19 employees [22 citations x 5 samples x (0.1 hrs. x \$84.69 hourly wage rate)];
- \$7,580 in mines with 20-500 employees [179 citations x 5 samples x (0.1 hrs. x \$84.69 hourly wage rate)]; and
- \$1,313 in mines with 501+ employees [31 citations x 5 samples x (0.1 hrs. x \$84.69 hourly wage rate)].

Third Year of the Final Rule

MSHA estimates that the costs to complete, sign, and transmit abatement sampling data to MSHA in the third year that the final rule is in effect are \$32,650 for underground coal mine operators. Costs for each mine size are shown below:

- \$2,795 in mines with 1-19 employees [66 citations x 5 samples x (0.1 hrs. x \$84.69 hourly wage rate)];
- \$24,729 in mines with 20-500 employees [584 citations x 5 samples x (0.1 hrs. x \$84.69 hourly wage rate)]; and
- \$5,124 in mines with 501+ employees [121 citations x 5 samples x (0.1 hrs. x \$84.69 hourly wage rate)].

Fourth Year of the Final Rule

MSHA estimates that the costs to complete, sign, and transmit abatement sampling data to MSHA in the fourth year that the final rule is in effect are \$11,950 for underground coal mine operators. Costs for each mine size are shown below:

- \$1,143 in mines with 1-19 employees [27 citations x 5 samples x (0.1 hrs. x \$84.69 hourly wage rate)];
- \$8,808 in mines with 20-500 employees [208 citations x 5 samples x (0.1 hrs. x \$84.69 hourly wage rate)]; and
- \$1,990 in mines with 501+ employees [47 citations x 5 samples x (0.1 hrs. x \$84.69 hourly wage rate)].

Fifth Year of the Final Rule and Every Year Thereafter

MSHA estimates that the costs to complete, sign, and transmit abatement sampling data to MSHA in the fifth year, and every year thereafter, that the final rule is in effect are \$7,500 for underground coal mine operators. Costs for each mine size are shown below:

- \$805 in mines with 1-19 employees [19 citations x 5 samples x (0.1 hrs. x \$84.69 hourly wage rate)];
- \$5,293 in mines with 20-500 employees [125 citations x 5 samples x (0.1 hrs. x \$84.69 hourly wage rate)]; and
- \$1,397 in mines with 501+ employees [33 citations x 5 samples x (0.1 hrs. x \$84.69 hourly wage rate)].

Under the final rule, the cost for underground coal mine operators to send abatement sampling information to MSHA changes each year until the fifth year, after which it remains constant. The Agency estimated costs that will be incurred over a 10-year period by multiplying each year's costs (excluding the costs in the first year) by a discount factor. MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at annual cost estimates of: \$1,433 for mines with 1-19 employees; \$10,956 for mines with 20-500 employees; and \$2,288 for mines with 501+ employees.

Surface Coal Mine Operators

First Year of the Final Rule

Surface coal mine operators with 20 or more employees will submit two samples per mailing since these mines on average operate two shifts per day. Mines with 1-19 employees will submit one sample per mailing since these mines mainly operate one shift per day. The cost per mailing is estimated to be \$1. MSHA estimates that the costs to complete, sign, and send Dust Data Cards, along with samples, to MSHA in the first year that the final rule is in effect are \$1,125 for surface coal mine operators. Costs for each mine size are shown below:

- \$587 in mines with 1-19 employees $[(21 \text{ citations} \times 5 \text{ samples} \times ((0.1 \text{ hrs.} \times \$28.13 \text{ hourly wage rate}) + (0.025 \text{ hrs.} \times \$71.18 \text{ hourly wage rate}))) + [21 \text{ citations} \times 5 \text{ samples} \times \$1]$;
- \$433 in mines with 20-500 employees $[(17 \text{ citations} \times 5 \text{ samples} \times ((0.1 \text{ hrs.} \times \$28.13 \text{ hourly wage rate}) + (0.025 \text{ hrs.} \times \$71.18 \text{ hourly wage rate}))) + [((17 \text{ citations} \times 5 \text{ samples}) / 2) \times \$1]$; and
- \$102 in mines with 501+ employees $[(4 \text{ citations} \times 5 \text{ samples} \times ((0.1 \text{ hrs.} \times \$28.13 \text{ hourly wage rate}) + (0.025 \text{ hrs.} \times \$71.18 \text{ hourly wage rate}))) + [((4 \text{ citations} \times 5 \text{ samples}) / 2) \times \$1]$.

Second Year of the Final Rule

MSHA estimates that the costs to complete, sign, and send Dust Data Cards, along with samples, to MSHA in the second year that the final rule is in effect are \$675 for surface coal mine operators. Costs for each mine size are shown below:

- \$364 in mines with 1-19 employees $[(13 \text{ citations} \times 5 \text{ samples} \times ((0.1 \text{ hrs.} \times \$28.13 \text{ hourly wage rate}) + (0.025 \text{ hrs.} \times \$71.18 \text{ hourly wage rate}))) + [13 \text{ citations} \times 5 \text{ samples} \times \$1]$;
- \$255 in mines with 20-500 employees $[(10 \text{ citations} \times 5 \text{ samples} \times ((0.1 \text{ hrs.} \times \$28.13 \text{ hourly wage rate}) + (0.025 \text{ hrs.} \times \$71.18 \text{ hourly wage rate}))) + [((10 \text{ citations} \times 5 \text{ samples}) / 2) \times \$1]$; and
- \$51 in mines with 501+ employees $[(2 \text{ citations} \times 5 \text{ samples} \times ((0.1 \text{ hrs.} \times \$28.13 \text{ hourly wage rate}) + (0.025 \text{ hrs.} \times \$71.18 \text{ hourly wage rate}))) + [((2 \text{ citations} \times 5 \text{ samples}) / 2) \times \$1]$.

Third Year of the Final Rule

MSHA estimates that the costs to complete, sign, and send Dust Data Cards, along with abatement samples, to MSHA in the third year that the final rule is in effect are \$875 for surface

coal mine operators. Costs for each mine size are shown below:

- \$447 in mines with 1-19 employees [(16 citations x 5 samples x ((0.1 hrs. x \$28.13 hourly wage rate) + (0.025 hrs. x \$71.18 hourly wage rate)) + [16 citations x 5 samples x \$1];
- \$331 in mines with 20-500 employees [(13 citations x 5 samples x ((0.1 hrs. x \$28.13 hourly wage rate) + (0.025 hrs. x \$71.18 hourly wage rate)) + (((13 citations x 5 samples) / 2) x \$1]; and
- \$76 in mines with 501+ employees [(3 citations x 5 samples x ((0.1 hrs. x \$28.13 hourly wage rate) + (0.025 hrs. x \$71.18 hourly wage rate)) + (((3 citations x 5 samples) / 2) x \$1].

Fourth Year of the Final Rule

MSHA estimates that the costs to complete, sign, and send Dust Data Cards, along with abatement samples, to MSHA in the fourth year that the final rule is in effect are \$500 for surface coal mine operators. Costs for each mine size are shown below:

- \$252 in mines with 1-19 employees [(9 citations x 5 samples x ((0.1 hrs. x \$28.13 hourly wage rate) + (0.025 hrs. x \$71.18 hourly wage rate)) + [9 citations x 5 samples x \$1];
- \$178 in mines with 20-500 employees [(7 citations x 5 samples x ((0.1 hrs. x \$28.13 hourly wage rate) + (0.025 hrs. x \$71.18 hourly wage rate)) + (((7 citations x 5 samples) / 2) x \$1]; and
- \$51 in mines with 501+ employees [(2 citations x 5 samples x ((0.1 hrs. x \$28.13 hourly wage rate) + (0.025 hrs. x \$71.18 hourly wage rate)) + (((2 citations x 5 samples) / 2) x \$1].

Fifth Year of the Final Rule and Every Year Thereafter

MSHA estimates that the costs to complete, sign, and send Dust Data Cards, along with abatement samples, to MSHA in the fifth year, and every year thereafter, that the final rule is in effect are \$450 for surface coal mine operators. Costs for each mine size are shown below:

- \$224 in mines with 1-19 employees [(8 citations x 5 samples x ((0.1 hrs. x \$28.13 hourly wage rate) + (0.025 hrs. x \$71.18 hourly wage rate)) + [8 citations x 5 samples x \$1];
- \$178 in mines with 20-500 employees [(7 citations x 5 samples x ((0.1 hrs. x \$28.13 hourly wage rate) + (0.025 hrs. x \$71.18 hourly wage rate)) + (((7 citations x 5 samples) / 2) x \$1]; and
- \$25 in mines with 501+ employees [(1 citation x 5 samples x ((0.1 hrs. x \$28.13 hourly wage rate) + (0.025 hrs. x \$71.18 hourly wage rate)) + (((1 citation x 5 samples) / 2) x \$1].

Under the final rule, the cost for surface coal mine operators to complete, sign, and send Dust Data Cards, along with abatement samples, to MSHA changes each year until the fifth year, after which it remains constant. The Agency estimated costs that will be incurred over a 10-year period by multiplying each year's costs (excluding the costs in the first year) by a discount factor. MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at annual cost

estimates of: \$340 for mines with 1-19 employees; \$255 for mines with 20-500 employees; and \$51 for mines with 501+ employees.

Post Sampling Data; Provide Sampling Data to the Part 90 Miner

Operators are required to post sampling data on the mine bulletin board under final §§ 70.211(b) and (c) at underground coal mines, and 71.208(b) and (c) at surface coal mines. Under § 90.209(b) and (c), underground and surface coal mine operators must provide part 90 miners with a copy of the sampling data and not post it. For purposes of this cost analysis, MSHA assumes that it takes the same amount of time to provide a copy of the sampling data to the part 90 miner as it does to post the sampling data on the mine bulletin board. On average, MSHA estimates that a clerical employee, earning \$28.67 per hour in an underground coal mine and \$23.91 in a surface coal mine, takes 6 minutes (0.1 hours) to copy and post the sampling data. MSHA estimates copying costs are \$0.15 per page. MSHA's current practice is to transmit the sampling reports in a group to the operator; the number of postings equals the number of citations.

Underground Coal Mine Operators

First Year of the Final Rule

MSHA estimates that the costs to post the sampling data in the first year that the final rule is in effect are \$2,050 for underground coal mine operators. Costs by mine size are shown below:

- \$190 in mines with 1-19 employees [63 postings x ((0.1 hrs. x \$28.67 hourly wage rate) + (1 pg. x \$0.15))];
- \$1,596 in mines with 20-500 employees [529 postings x ((0.1 hrs. x \$28.67 hourly wage rate) + (1 pg. x \$0.15))]; and
- \$250 in mines with 501+ employees [83 postings x ((0.1 hrs. x \$28.67 hourly wage rate) + (1 pg. x \$0.15))].

Second Year of the Final Rule

MSHA estimates that the costs to post the sampling data in the second year that the final rule is in effect are \$1,425 for underground coal mine operators. Costs by mine size are shown below:

- \$136 in mines with 1-19 employees [45 postings x ((0.1 hrs. x \$28.67 hourly wage rate) + (1 pg. x \$0.15))];
- \$1,083 in mines with 20-500 employees [359 postings x ((0.1 hrs. x \$28.67 hourly wage rate) + (1 pg. x \$0.15))]; and
- \$190 in mines with 501+ employees [63 postings x ((0.1 hrs. x \$28.67 hourly wage rate) + (1 pg. x \$0.15))].

Third Year of the Final Rule

MSHA estimates that the costs to post the sampling data in the third year that the final rule is in effect are \$2,350 for underground coal mine operators. Costs by mine size are shown below:

- \$199 in mines with 1-19 employees [66 postings x ((0.1 hrs. x \$28.67 hourly wage rate) + (1 pg. x \$0.15))];
- \$1,762 in mines with 20-500 employees [584 postings x ((0.1 hrs. x \$28.67 hourly wage rate) + (1 pg. x \$0.15))]; and
- \$365 in mines with 501+ employees [121 postings x ((0.1 hrs. x \$28.67 hourly wage rate) + (1 pg. x \$0.15))].

Fourth Year of the Final Rule

MSHA estimates that the costs to post the sampling data in the fourth year that the final rule is in effect are \$925 for underground coal mine operators. Costs by mine size are shown below:

- \$139 in mines with 1-19 employees [46 postings x ((0.1 hrs. x \$28.67 hourly wage rate) + (1 pg. x \$0.15))];
- \$628 in mines with 20-500 employees [208 postings x ((0.1 hrs. x \$28.67 hourly wage rate) + (1 pg. x \$0.15))]; and
- \$142 in mines with 501+ employees [47 postings x ((0.1 hrs. x \$28.67 hourly wage rate) + (1 pg. x \$0.15))].

Fifth Year of the Final Rule and Every Year Thereafter

MSHA estimates that the costs to post the sampling data in the fifth year that the final rule is in effect, and every year thereafter, are \$550 for underground coal mine operators. Costs by mine size are shown below:

- \$57 in mines with 1-19 employees [19 postings x ((0.1 hrs. x \$28.67 hourly wage rate) + (1 pg. x \$0.15))];
- \$377 in mines with 20-500 employees [125 postings x ((0.1 hrs. x \$28.67 hourly wage rate) + (1 pg. x \$0.15))]; and
- \$100 in mines with 501+ employees [33 postings x ((0.1 hrs. x \$28.67 hourly wage rate) + (1 pg. x \$0.15))].

Under the final rule, the cost to post the sampling data at the underground coal mines changes each year until the fifth year, after which it remains constant. The Agency estimated costs that will be incurred over a 10-year period by multiplying each year's costs (excluding the costs in the first year) by a discount factor. MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at annual cost estimates of: \$117 for mines with 1-19 employees; \$870 for mines with 20-500 employees; and \$177 for mines with 501+ employees.

Surface Coal Mine Operators

First Year of the Final Rule

MSHA estimates that the costs to post the sampling data in the first year that the final rule is in effect are \$125 for surface coal mine operators. Costs by mine size are shown below:

- \$53 in mines with 1-19 employees [21 postings x ((0.1 hrs. x \$23.91 hourly wage rate) + (1 pg. x \$0.15))];

- \$43 in mines with 20-500 employees [17 postings x ((0.1 hrs. x \$23.91 hourly wage rate) + (1 pg. x \$0.15))]; and
- \$10 in mines with 501+ employees [4 postings x ((0.1 hrs. x \$23.91 hourly wage rate) + (1 pg. x \$0.15))].

Second Year of the Final Rule

MSHA estimates that the costs to post the sampling data in the second year that the final rule is in effect are \$75 for surface coal mine operators. Costs by mine size are shown below:

- \$33 in mines with 1-19 employees [13 postings x ((0.1 hrs. x \$23.91 hourly wage rate) + (1 pg. x \$0.15))];
- \$25 in mines with 20-500 employees [10 postings x ((0.1 hrs. x \$23.91 hourly wage rate) + (1 pg. x \$0.15))]; and
- \$5 in mines with 501+ employees [2 postings x ((0.1 hrs. x \$23.91 hourly wage rate) + (1 pg. x \$0.15))].

Third Year of the Final Rule

MSHA estimates that the costs to post the sampling data in the third year that the final rule is in effect are \$100 for surface coal mine operators. Costs by mine size are shown below:

- \$41 in mines with 1-19 employees [16 postings x ((0.1 hrs. x \$23.91 hourly wage rate) + (1 pg. x \$0.15))];
- \$33 in mines with 20-500 employees [13 postings x ((0.1 hrs. x \$23.91 hourly wage rate) + (1 pg. x \$0.15))]; and
- \$8 in mines with 501+ employees [3 postings x ((0.1 hrs. x \$23.91 hourly wage rate) + (1 pg. x \$0.15))].

Fourth Year of the Final Rule

MSHA estimates that the costs to post the sampling data in the fourth year that the final rule is in effect are \$50 for surface coal mine operators. Costs by mine size are shown below:

- \$23 in mines with 1-19 employees [9 postings x ((0.1 hrs. x \$23.91 hourly wage rate) + (1 pg. x \$0.15))];
- \$18 in mines with 20-500 employees [7 postings x ((0.1 hrs. x \$23.91 hourly wage rate) + (1 pg. x \$0.15))]; and
- \$5 in mines with 501+ employees [2 postings x ((0.1 hrs. x \$23.91 hourly wage rate) + (1 pg. x \$0.15))].

Fifth Year of the Final Rule and Every Year Thereafter

MSHA estimates that the costs to post the sampling data in the fifth year that the final rule is in effect are \$50 for surface coal mine operators. Costs by mine size are shown below:

- \$20 in mines with 1-19 employees [8 postings x ((0.1 hrs. x \$23.91 hourly wage rate) + (1 pg. x \$0.15))];
- \$18 in mines with 20-500 employees [7 postings x ((0.1 hrs. x \$23.91 hourly wage rate) + (1 pg. x \$0.15))]; and
- \$3 in mines with 501+ employees [1 posting x ((0.1 hrs. x \$23.91 hourly wage rate) + (1 pg. x \$0.15))].

Under the final rule, the cost to post the sampling data at surface coal mines changes each year until the fifth year, after which it remains constant. The Agency estimated costs that will be incurred over a 10-year period by multiplying each year's costs (excluding the costs in the first year) by a discount factor. MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at annual cost estimates of: \$31 for mines with 1-19 employees; \$25 for mines with 20-500 employees; and \$5 for mines with 501+ employees.

Revisions to Mine Ventilation Plan or Develop or Revise Dust Control Plan

To terminate a citation for violation of the respirable dust standard under the final rule, operators may make revisions to mine ventilation plans under §§ 70.206(i)(2), 70.207(h)(2), 70.208(i)(2), and 70.209(g)(2) at underground coal mines; develop or make revisions to respirable dust control plans under § 71.300(a) at surface coal mines; and develop or make revisions to respirable dust control plans under § 90.300(a) for part 90 miners. There are occasions when a citation will not result in an operator having to make a revision to the mine ventilation plan or develop or revise a dust control plan because the citation can be abated by simply following the current plan. However, as a conservative estimate for this analysis, MSHA assumes that all citations will require a revision to the mine ventilation plan or development or revision of a dust control plan. Thus, the number of plan developments or revisions is equal to the number of citations.

On average, MSHA estimates that it takes a supervisor, earning \$84.69 per hour in an underground coal mine and \$71.18 per hour in a surface coal mine, 15 minutes (0.25 hours) to develop or make a plan revision. Also, MSHA estimates that it takes a clerical employee, earning \$28.67 in an underground coal mine and \$23.91 in a surface coal mine, another 15 minutes (0.25 hours) to prepare and send the material to MSHA. MSHA estimates copy and postage costs are \$1.30 per plan development or revision [(2 pgs. x \$0.15 per page) + \$1 postage].

Underground Coal Mine Operators

First Year of the Final Rule

MSHA estimates that the costs to develop or revise plans in the first year that the rule is in effect are \$20,025 for underground coal mine operators. Costs for each mine size are shown below:

- \$1,867 in mines with 1-19 employees [63 plans x ((0.25 hrs. x \$84.69 hourly wage rate) + (0.25 hrs. x \$28.67 hourly wage rate) + \$1.30)];
- \$15,680 in mines with 20-500 employees [529 plans x ((0.25 hrs. x \$84.69 hourly wage rate) + (0.25 hrs. x \$28.67 hourly wage rate) + \$1.30)]; and
- \$2,460 in mines with 501+ employees [83 plans x ((0.25 hrs. x \$84.69 hourly wage rate) + (0.25 hrs. x \$28.67 hourly wage rate) + \$1.30)].

Second Year of the Final Rule

MSHA estimates that the costs to develop or revise plans in the second year that the rule is in effect are \$13,850 for underground coal mine operators. Costs for each mine size are shown below:

- \$1,334 in mines with 1-19 employees [45 plans x ((0.25 hrs. x \$84.69 hourly wage rate) + (0.25 hrs. x \$28.67 hourly wage rate) + \$1.30)];
- \$10,641 in mines with 20-500 employees [359 plans x ((0.25 hrs. x \$84.69 hourly wage rate) + (0.25 hrs. x \$28.67 hourly wage rate) + \$1.30)]; and
- \$1,867 in mines with 501+ employees [63 plans x ((0.25 hrs. x \$84.69 hourly wage rate) + (0.25 hrs. x \$28.67 hourly wage rate) + \$1.30)].

Third Year of the Final Rule

MSHA estimates that the costs to develop or revise plans in the third year that the rule is in effect are \$22,875 for underground coal mine operators. Costs for each mine size are shown below:

- \$1,956 in mines with 1-19 employees [66 plans x ((0.25 hrs. x \$84.69 hourly wage rate) + (0.25 hrs. x \$28.67 hourly wage rate) + \$1.30)];
- \$17,310 in mines with 20-500 employees [584 plans x ((0.25 hrs. x \$84.69 hourly wage rate) + (0.25 hrs. x \$28.67 hourly wage rate) + \$1.30)]; and
- \$3,586 in mines with 501+ employees [121 plans x ((0.25 hrs. x \$84.69 hourly wage rate) + (0.25 hrs. x \$28.67 hourly wage rate) + \$1.30)].

Fourth Year of the Final Rule

MSHA estimates that the costs to develop or revise plans in the fourth year that the rule is in effect are \$8,375 for underground coal mine operators. Costs for each mine size are shown below:

- \$800 in mines with 1-19 employees [27 plans x ((0.25 hrs. x \$84.69 hourly wage rate) + (0.25 hrs. x \$28.67 hourly wage rate) + \$1.30)];
- \$6,165 in mines with 20-500 employees [208 plans x ((0.25 hrs. x \$84.69 hourly wage rate) + (0.25 hrs. x \$28.67 hourly wage rate) + \$1.30)]; and
- \$1,393 in mines with 501+ employees [47 plans x ((0.25 hrs. x \$84.69 hourly wage rate) + (0.25 hrs. x \$28.67 hourly wage rate) + \$1.30)].

Fifth Year of the Final Rule and Every Year Thereafter

MSHA estimates that the costs to develop or revise plans in the fifth year that the rule is in effect, and every year thereafter, are \$5,250 for underground coal mine operators. Costs for each mine size are shown below:

- \$563 in mines with 1-19 employees [19 plans x ((0.25 hrs. x \$84.69 hourly wage rate) + (0.25 hrs. x \$28.67 hourly wage rate) + \$1.30)];
- \$3,705 in mines with 20-500 employees [125 plans x ((0.25 hrs. x \$84.69 hourly wage rate) + (0.25 hrs. x \$28.67 hourly wage rate) + \$1.30)]; and
- \$978 in mines with 501+ employees [33 plans x ((0.25 hrs. x \$84.69 hourly wage rate) + (0.25 hrs. x \$28.67 hourly wage rate) + \$1.30)].

Under the final rule, the cost to revise mine ventilation plans or develop or revise a dust control plan for underground coal mines changes each year until the fifth year, after which it remains constant. The Agency estimated costs that will be incurred over a 10-year period by multiplying each year's costs (excluding the costs in the first year) by a discount factor. MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a

factor of 0.142 based on a 7 percent discount rate to arrive at annual cost estimates of: \$1,088 for mines with 1-19 employees; \$8,545 for mines with 20-500 employees; and \$1,743 for mines with 501+ employees.

Surface Coal Mine Operators

First Year of the Final Rule

MSHA estimates that the costs to develop or revise plans in the first year that the rule is in effect are \$1,075 for surface coal mine operators. Costs for each mine size are shown below:

- \$527 in mines with 1-19 employees [21 plans x ((0.25 hrs. x \$71.18 hourly wage rate) + (0.25 hrs. x \$23.91 hourly wage rate) + \$1.30)];
- \$426 in mines with 20-500 employees [17 plans x ((0.25 hrs. x \$71.18 hourly wage rate) + (0.25 hrs. x \$23.91 hourly wage rate) + \$1.30)]; and
- \$100 in mines with 501+ employees [4 plans x ((0.25 hrs. x \$71.18 hourly wage rate) + (0.25 hrs. x \$23.91 hourly wage rate) + \$1.30)].

Second Year of the Final Rule

MSHA estimates that the costs to develop or revise plans in the second year that the rule is in effect are \$650 for surface coal mine operators. Costs for each mine size are shown below:

- \$326 in mines with 1-19 employees [13 plans x ((0.25 hrs. x \$71.18 hourly wage rate) + (0.25 hrs. x \$23.91 hourly wage rate) + \$1.30)];
- \$251 in mines with 20-500 employees [10 plans x ((0.25 hrs. x \$71.18 hourly wage rate) + (0.25 hrs. x \$23.91 hourly wage rate) + \$1.30)]; and
- \$50 in mines with 501+ employees [2 plans x ((0.25 hrs. x \$71.18 hourly wage rate) + (0.25 hrs. x \$23.91 hourly wage rate) + \$1.30)].

Third Year of the Final Rule

MSHA estimates that the costs to develop or revise plans in the third year that the rule is in effect are \$825 for surface coal mine operators. Costs for each mine size are shown below:

- \$401 in mines with 1-19 employees [16 plans x ((0.25 hrs. x \$71.18 hourly wage rate) + (0.25 hrs. x \$23.91 hourly wage rate) + \$1.30)];
- \$326 in mines with 20-500 employees [13 plans x ((0.25 hrs. x \$71.18 hourly wage rate) + (0.25 hrs. x \$23.91 hourly wage rate) + \$1.30)]; and
- \$75 in mines with 501+ employees [3 plans x ((0.25 hrs. x \$71.18 hourly wage rate) + (0.25 hrs. x \$23.91 hourly wage rate) + \$1.30)].

Fourth Year of the Final Rule

MSHA estimates that the costs to develop or revise plans in the fourth year that the rule is in effect are \$450 for surface coal mine operators. Costs for each mine size are shown below:

- \$226 in mines with 1-19 employees [9 plans x ((0.25 hrs. x \$71.18 hourly wage rate) + (0.25 hrs. x \$23.91 hourly wage rate) + \$1.30)];
- \$176 in mines with 20-500 employees [7 plans x ((0.25 hrs. x \$71.18 hourly wage rate) + (0.25 hrs. x \$23.91 hourly wage rate) + \$1.30)]; and

- \$50 in mines with 501+ employees [2 plans x ((0.25 hrs. x \$71.18 hourly wage rate) + (0.25 hrs. x \$23.91 hourly wage rate) + \$1.30)].

Fifth Year of the Final Rule and Every Year Thereafter

MSHA estimates that the costs to develop or revise plans in the fifth year that the rule is in effect, and every year thereafter, are \$400 for surface coal mine operators. Costs for each mine size are shown below:

- \$201 in mines with 1-19 employees [8 plans x ((0.25 hrs. x \$71.18 hourly wage rate) + (0.25 hrs. x \$23.91 hourly wage rate) + \$1.30)];
- \$176 in mines with 20-500 employees [7 plans x ((0.25 hrs. x \$71.18 hourly wage rate) + (0.25 hrs. x \$23.91 hourly wage rate) + \$1.30)]; and
- \$25 in mines with 501+ employees [1 plan x ((0.25 hrs. x \$71.18 hourly wage rate) + (0.25 hrs. x \$23.91 hourly wage rate) + \$1.30)].

Under the final rule, the cost to develop or revise respirable dust control plans for surface coal mines changes each year until the fifth year, after which it remains constant. The Agency estimated costs that will be incurred over a 10-year period by multiplying each year's costs (excluding the costs in the first year) by a discount factor. MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at annual cost estimates of: \$305 for mines with 1-19 employees; \$251 for mines with 20-500 employees; and \$50 for mines with 501+ employees.

Notify Miners' Representative or Part 90 Miner

Operators are required to notify the miners' representatives of developed or revised plans and, if requested, provide them with a copy (under existing § 75.370(a)(3)(i) and (f)(1) for underground coal mine operators and final §§ 71.300(a)(1) and 71.301(d)(1) for surface coal mine operators), and provide the part 90 miner with a copy of a developed or revised plan (under final § 90.301(d)). As a result of additional citations resulting from the final rule, operators will make changes to their existing mine ventilation plans and develop or revise their respirable dust control plans, and miners' representatives will be notified of the change. MSHA estimates that it takes a clerical employee (earning \$28.67 per hour in an underground coal mine and \$23.91 in a surface coal mine) 15 minutes (0.25 hours) to notify and provide a copy of the plan or revisions to the miners' representative or part 90 miner. MSHA assumes that all miners' representatives will request a copy of the plan or revisions. MSHA estimates that, on average, copy costs are \$0.30 (2 pgs. x \$0.15 per page). There are no postage costs because MSHA assumes that a copy of the plan or plan revisions will be given to each miners' representative or part 90 miner at the mine site. Since MSHA conservatively assumes that all additional citations will require a revision to the mine ventilation plan or develop or revise the respirable dust control plan, the number of notifications is equal to the number of additional citations.

Underground Coal Mine Operators

First Year of the Final Rule

In the first year that the rule is in effect, MSHA estimates that the costs to notify the miners' representatives or part 90 miners and provide them with a copy of the plan or revisions are \$5,050 for underground coal mine operators. Costs for each mine size are shown below:

- \$470 in mines with 1-19 employees [63 notifications x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)];
- \$3,950 in mines with 20-500 employees [529 notifications x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)]; and
- \$620 in mines with 501+ employees [83 notifications x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)].

Second Year of the Final Rule

In the second year that the rule is in effect, MSHA estimates that the costs to notify the representatives or part 90 miners and provide them with a copy of the plan or revisions are \$3,500 for underground coal mine operators. Costs for each mine size are shown below:

- \$336 in mines with 1-19 employees [45 notifications x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)];
- \$2,681 in mines with 20-500 employees [359 notifications x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)]; and
- \$470 in mines with 501+ employees [63 notifications x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)].

Third Year of the Final Rule

In the third year that the rule is in effect, MSHA estimates that the costs to notify the miners' representatives or part 90 miners and provide them with a copy of the plan are \$5,775 for underground coal mine operators. Costs for each mine size are shown below:

- \$493 in mines with 1-19 employees [66 notifications x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)];
- \$4,361 in mines with 20-500 employees [584 notifications x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)]; and
- \$904 in mines with 501+ employees [121 notifications x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)].

Fourth Year of the Final Rule

In the fourth year that the rule is in effect, MSHA estimates that the costs to notify the miners' representatives or part 90 miners and provide them with a copy of the plan or revisions are \$2,125 for underground coal mine operators. Costs for each mine size are shown below:

- \$202 in mines with 1-19 employees [27 notifications x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)];
- \$1,553 in mines with 20-500 employees [208 notifications x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)]; and
- \$351 in mines with 501+ employees [47 notifications x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)].

Fifth Year of the Final Rule

In the fifth year that the rule is in effect, and every year thereafter, MSHA estimates that the costs to notify the miners' representatives or part 90 miners and provide them with a copy of the plan or revisions are \$1,325 for underground coal mine operators. Costs for each mine size are shown below:

- \$142 in mines with 1-19 employees [19 notifications x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)];
- \$933 in mines with 20-500 employees [125 notifications x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)]; and
- \$246 in mines with 501+ employees [33 notifications x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)].

Under the final rule, the cost to notify miners' representatives or part 90 miners and provide them with a copy of the revised mine ventilation plan or dust control plan or revisions for underground coal mines changes each year until the fifth year, after which it remains constant. The Agency estimated costs that will be incurred over a 10-year period by multiplying each year's costs (excluding the costs in the first year) by a discount factor. MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at annual cost estimates of: \$274 for mines with 1-19 employees; \$2,153 for mines with 20-500 employees; and \$439 for mines with 501+ employees.

Surface Coal Mine Operators

First Year of the Final Rule

In the first year that the rule is in effect, MSHA estimates that the costs to notify the miners' representatives or part 90 miners and provide them with a copy of the plan or revisions are \$275 for surface coal mine operators. Costs for each mine size are shown below:

- \$132 in mines with 1-19 employees [21 notifications x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)];
- \$107 in mines with 20-500 employees [17 notifications x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)]; and
- \$25 in mines with 501+ employees [4 notifications x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)].

Second Year of the Final Rule

In the second year that the rule is in effect, MSHA estimates that the costs to notify the miners' representatives or part 90 miners and provide them with a copy of the plan or revisions are \$175 for surface coal mine operators. Costs for each mine size are shown below:

- \$82 in mines with 1-19 employees [13 notifications x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)];
- \$63 in mines with 20-500 employees [10 notifications x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)]; and
- \$13 in mines with 501+ employees [2 notifications x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)].

Third Year of the Final Rule

In the third year that the rule is in effect, MSHA estimates that the costs to notify the miners' representatives or part 90 miners and provide them with a copy of the plan or revisions are \$200 for surface coal mine operators. Costs for each mine size are shown below:

- \$100 in mines with 1-19 employees [16 notifications x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)];
- \$82 in mines with 20-500 employees [13 notifications x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)]; and
- \$19 in mines with 501+ employees [3 notifications x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)].

Fourth Year of the Final Rule

In the fourth year that the rule is in effect, MSHA estimates that the costs to notify the miners' representatives or part 90 miners and provide them with a copy of the plan or revisions are \$125 for surface coal mine operators. Costs for each mine size are shown below:

- \$56 in mines with 1-19 employees [9 notifications x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)];
- \$44 in mines with 20-500 employees [7 notifications x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)]; and
- \$13 in mines with 501+ employees [2 notifications x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)].

Fifth Year of the Final Rule and Every Year Thereafter

In the fifth year that the rule is in effect, and every year thereafter, MSHA estimates that the costs to notify the miners' representatives or part 90 miners and provide them with a copy of the plan or revisions are \$100 for surface coal mine operators. Costs for each mine size are shown below:

- \$50 in mines with 1-19 employees [8 notifications x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)];
- \$44 in mines with 20-500 employees [7 notifications x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)]; and
- \$6 in mines with 501+ employees [1 notification x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)].

Under the final rule, the cost to notify the miners' representatives and provide them with a copy of the respirable dust control plan or revisions for surface coal mines changes each year until the fifth year, after which it remains constant. The Agency estimated costs that will be incurred over a 10-year period by multiplying each year's costs (excluding the costs in the first year) by a discount factor. MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at annual cost estimates of: \$76 for mines with 1-19 employees; \$63 for mines with 20-500 employees; and \$12 for mines with 501+ employees.

Post Copy of Plan or Revision

Underground coal mine operators must post a copy of mine ventilation plan revisions under existing § 75.370(a)(3)(iii) and (f)(3). Surface coal mine operators must post a copy of dust control plan or revisions under final §§ 71.300(a)(3) and 71.301(d)(3). The number of postings equals the number of citations issued for violation of the respirable dust standard

resulting from the final rule. MSHA estimates that a clerical employee, earning \$28.67 in an underground coal mine and \$23.91 in a surface coal mine, takes 15 minutes (0.25 hours) to copy and post a plan or revision. Copy costs are \$0.30 (2 pgs. x \$0.15 per page). There are no postage costs.

Underground Coal Mine Operators

First Year of the Final Rule

MSHA estimates that costs to copy and post plan or revisions in the first year the final rule is in effect are \$5,050 for underground coal mine operators. Costs for each mine size are shown below:

- \$470 in mines with 1-19 employees [63 postings x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)];
- \$3,950 in mines with 20-500 employees [529 postings x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)]; and
- \$620 in mines with 501+ employees [83 postings x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)].

Second Year of the Final Rule

MSHA estimates that costs to copy and post plan or revisions in the second year the final rule is in effect are \$3,500 for underground coal mine operators. Costs for each mine size are shown below:

- \$336 in mines with 1-19 employees [45 postings x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)];
- \$2,681 in mines with 20-500 employees [359 postings x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)]; and
- \$470 in mines with 501+ employees [63 postings x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)].

Third Year of the Final Rule

MSHA estimates that costs to copy and post plan or revisions in the third year that the final rule is in effect are \$5,775 for underground coal mine operators. Costs for each mine size are shown below:

- \$493 in mines with 1-19 employees [66 postings x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)];
- \$4,361 in mines with 20-500 employees [584 postings x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)]; and
- \$904 in mines with 501+ employees [121 postings x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)].

Fourth Year of the Final Rule

MSHA estimates that costs to copy and post plan or revisions in the fourth year that the final rule is in effect are \$2,125 for underground coal mine operators. Costs for each mine size are shown below:

- \$202 in mines with 1-19 employees [27 postings x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)];
- \$1,553 in mines with 20-500 employees [208 postings x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)]; and
- \$351 in mines with 501+ employees [47 postings x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)].

Fifth Year of the Final Rule and Every Year Thereafter

MSHA estimates that costs to copy and post plan or revisions in the fifth year that the final rule is in effect, and every year thereafter, are \$1,325 for underground coal mine operators. Costs for each mine size are shown below:

- \$142 in mines with 1-19 employees [19 postings x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)];
- \$933 in mines with 20-500 employees [125 postings x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)]; and
- \$246 in mines with 501+ employees [33 postings x ((0.25 hrs. x \$28.67 hourly wage rate) + \$0.30)].

Under the final rule, the cost to copy and post mine ventilation plan revisions or develop or revise a dust control plan for an underground coal mines changes each year until the fifth year, after which it remains constant. The Agency estimated costs that will be incurred over a 10-year period by multiplying each year's costs (excluding the costs in the first year) by a discount factor. MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at annual cost estimates of: \$274 for mines with 1-19 employees; \$2,153 for mines with 20-500 employees; and \$439 for mines with 501+ employees.

Surface Coal Mine Operators

First Year of the Final Rule

MSHA estimates that costs to copy and post the plan or revisions in the first year the final rule is in effect are \$275 for surface coal mine operators. Costs for each mine size are shown below:

- \$132 in mines with 1-19 employees [21 postings x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)];
- \$107 in mines with 20-500 employees [17 postings x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)]; and
- \$25 in mines with 501+ employees [4 postings x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)].

Second Year of the Final Rule

MSHA estimates that costs to copy and post the plan or revisions in the second year the final rule is in effect are \$175 for surface coal mine operators. Costs for each mine size are shown below:

- \$82 in mines with 1-19 employees [13 postings x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)];
- \$63 in mines with 20-500 employees [10 postings x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)]; and
- \$13 in mines with 501+ employees [2 postings x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)].

Third Year of the Final Rule

MSHA estimates that costs to copy and post the plan or revisions in the third year that the final rule is in effect are \$200 for surface coal mine operators. Costs for each mine size are shown below:

- \$100 in mines with 1-19 employees [16 postings x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)];
- \$82 in mines with 20-500 employees [13 postings x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)]; and
- \$19 in mines with 501+ employees [3 postings x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)].

Fourth Year of the Final Rule

MSHA estimates that costs to copy and post the plan or revisions in the fourth year that the final rule is in effect are \$125 for surface coal mine operators. Costs for each mine size are shown below:

- \$56 in mines with 1-19 employees [9 postings x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)];
- \$44 in mines with 20-500 employees [7 postings x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)]; and
- \$13 in mines with 501+ employees [2 postings x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)].

Fifth Year of the Final Rule and Every Year Thereafter

MSHA estimates that costs to copy and post the plan or revisions in the fifth year that the final rule is in effect, and every year thereafter, are \$100 for surface coal mine operators. Costs for each mine size are shown below:

- \$50 in mines with 1-19 employees [8 postings x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)];
- \$44 in mines with 20-500 employees [7 postings x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)]; and
- \$6 in mines with 501+ employees [1 posting x ((0.25 hrs. x \$23.91 hourly wage rate) + \$0.30)].

Under the final rule, the cost to copy and post respirable dust control plans or revisions for surface coal mines changes each year until the fifth year, after which it remains constant. The Agency estimated costs that will be incurred over a 10-year period by multiplying each year's costs (excluding the costs in the first year) by a discount factor. MSHA then summed

these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at annual cost estimates of: \$76 for mines with 1-19 employees; \$63 for mines with 20-500 employees; and \$12 for mines with 501+ employees.

Summary of Abatement Cost Estimates

Table IV-17 shows annual abatement cost estimates for underground coal mine operators, by mine size. MSHA estimates underground coal mine operators' annual costs related to receiving additional citations to be \$225,950 (excluding penalty charges).

Table IV-17: Underground Coal Mine Annual Abatement Cost Estimates

Description	Underground Coal Mines			
	1-19	20-500	501+	Total
Implement Corrective Actions	\$9,181	\$72,074	\$14,705	\$95,959
Record & Certify Corrective Actions	\$622	\$4,883	\$996	\$6,501
Conduct Abatement Sampling	\$8,609	\$68,989	\$12,929	\$90,526
Complete, Sign & Send Dust Card to MSHA	\$1,433	\$10,956	\$2,288	\$14,678
Post Sampling Data or Provide to Part 90 Miner	\$117	\$870	\$177	\$1,165
Make Revisions to Plans	\$1,088	\$8,545	\$1,743	\$11,377
Notify Miner Rep. of Revisions; Provide to Part 90 Miner	\$274	\$2,153	\$439	\$2,866
Post Plan Revisions	\$274	\$2,153	\$439	\$2,866
Total	\$21,599	\$170,622	\$33,718	\$225,939

Table IV-18 shows annual abatement estimates for surface coal mine operators, by mine size. MSHA estimates surface coal mine operators' annual costs related to receiving additional citations to be \$17,100 (excluding penalty charges).

Table IV-18: Surface Coal Mine Annual Abatement Cost Estimates

Description	Surface Coal Mines			
	1-19	20-500	501+	Total
Implement Corrective Actions	\$3,038	\$2,508	\$497	\$6,043
Record & Certify Corrective Actions	\$173	\$143	\$28	\$344
Conduct Abatement Sampling	\$4,562	\$3,765	\$747	\$9,074
Complete, Sign & Send Dust Card to MSHA	\$340	\$255	\$51	\$646
Post Sampling Data or Provide to Part 90 Miner	\$31	\$25	\$5	\$61
Make Revisions to Plans	\$305	\$251	\$50	\$606
Notify Miner Rep. of Revisions; Provide to Part 90 Miner	\$76	\$63	\$12	\$152
Post Plan Revisions	\$76	\$63	\$12	\$152
Total	\$8,601	\$7,074	\$1,403	\$17,079

Penalty Estimates from Additional Citations

As a result of additional citations, operators will incur penalties. MSHA does not consider penalties to be a cost of the rule because the Agency considers them to be transfer payments. However, MSHA calculated the penalties because the Agency adds them to the costs of the rule when determinations are made on the economic feasibility of the rule and on small business impacts.

For this analysis, MSHA assumes that each citation results in a penalty to the operator. The average penalty paid will vary each year. The average penalty per citation based on penalties paid by underground coal mine operators in 2008 and 2009 for citations for overexposure to respirable coal mine dust was: \$898 for mines with 1-19 employees; \$2,327 for mines with 20-500 employees; and \$2,728 for mines with 501+ employees. The average penalty per citation based on penalties paid by surface coal mine operators in 2008 and 2009 was \$907 for mines with 1-19 employees, and \$1,154 for mines with 20 or more employees. MSHA used these averages to estimate the impact of additional citations on the mine operators.

Underground Coal Mine Operators

First Year of the Final Rule

MSHA estimates that penalties in the first year the final rule is in effect are \$1.51 million for underground coal mine operators. Penalties for each mine size are shown below:

- \$56,574 in mines with 1-19 employees (63 citations x \$898 penalty charge per citation);
- \$1,230,983 in mines with 20-500 employees (529 citations x \$2,327 penalty charge per citation); and
- \$226,424 in mines with 501+ employees (83 citations x \$2,728 penalty charge per citation).

Second Year of the Final Rule

MSHA estimates that penalties in the second year the final rule is in effect are \$1.05 million for underground coal mine operators. Penalties for each mine size are shown below:

- \$40,410 in mines with 1-19 employees (45 citations x \$898 penalty charge per citation);
- \$835,393 in mines with 20-500 employees (359 citations x \$2,327 penalty charge per citation); and
- \$171,864 in mines with 501+ employees (63 citations x \$2,728 penalty charge per citation).

Third Year of the Final Rule

MSHA estimates that penalties in the third year that the final rule is in effect are \$1.75 million for underground coal mine operators. Penalties for each mine size are shown below:

- \$59,268 in mines with 1-19 employees (66 citations x \$898 penalty charge per citation);
- \$1,358,968 in mines with 20-500 employees (584 citations x \$2,327 penalty charge per citation); and
- \$330,088 in mines with 501+ employees (121 citations x \$2,728 penalty charge per citation).

Fourth Year of the Final Rule

MSHA estimates that penalties in the fourth year that the final rule is in effect are \$0.6 million for underground coal mine operators. Penalties for each mine size are shown below:

- \$24,246 in mines with 1-19 employees (27 citations x \$898 penalty charge per citation);
- \$484,016 in mines with 20-500 employees (208 citations x \$2,327 penalty charge per citation); and
- \$128,216 in mines with 501+ employees (47 citations x \$2,728 penalty charge per citation).

Fifth Year of the Final Rule and Every Year Thereafter

MSHA estimates that penalties in the fifth year that the final rule is in effect, and every year thereafter, are \$0.4 million for underground coal mine operators. Penalties for each mine size are shown below:

- \$17,062 in mines with 1-19 employees (19 citations x \$898 penalty charge per citation);
- \$290,875 in mines with 20-500 employees (125 citations x \$2,327 penalty charge per citation); and
- \$90,024 in mines with 501+ employees (33 citations x \$2,728 penalty charge per citation).

Under the final rule, penalties for underground coal mines change each year until the fifth year, after which they remain constant. The Agency estimated penalties that will be incurred over a 10-year period by multiplying each year's penalties (excluding the penalties in the first year) by a discount factor. MSHA then summed these discounted penalties and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at annual penalty estimates of: \$32,977 for mines with 1-19 employees; \$670,861 for mines with 20-500 employees; and \$160,463 for mines with 501+ employees.

Surface Coal Mine Operators

First Year of the Final Rule

MSHA estimates that penalties in the first year the final rule is in effect are \$43,300 for surface coal mine operators. Penalties for each mine size are shown below:

- \$19,047 in mines with 1-19 employees (21 citations x \$907 penalty charge per citation);
- \$19,618 in mines with 20-500 employees (17 citations x \$1,154 penalty charge per citation); and
- \$4,616 in mines with 501+ employees (4 citations x \$1,154 penalty charge per citation).

Second Year of the Final Rule

MSHA estimates that penalties in the second year the final rule is in effect are \$25,650 for surface coal mine operators. Penalties for each mine size are shown below:

- \$11,791 in mines with 1-19 employees (13 citations x \$907 penalty charge per citation);
- \$11,540 in mines with 20-500 employees (10 citations x \$1,154 penalty charge per citation); and
- \$2,308 in mines with 501+ employees (2 citations x \$1,154 penalty charge per citation).

Third Year of the Final Rule

MSHA estimates that penalties in the third year that the final rule is in effect are \$32,975 for surface coal mine operators. Penalties for each mine size are shown below:

- \$14,512 in mines with 1-19 employees (16 citations x \$907 penalty charge per citation);
- \$15,002 in mines with 20-500 employees (13 citations x \$1,154 penalty charge per citation); and
- \$3,462 in mines with 501+ employees (3 citations x \$1,154 penalty charge per citation).

Fourth Year of the Final Rule

MSHA estimates that penalties in the fourth year that the final rule is in effect are \$18,550 for surface coal mine operators. Penalties for each mine size are shown below:

- \$8,163 in mines with 1-19 employees (9 citations x \$907 penalty charge per citation);
- \$8,078 in mines with 20-500 employees (7 citations x \$1,154 penalty charge per citation); and
- \$2,308 in mines with 501+ employees (2 citations x \$1,154 penalty charge per citation).

Fifth Year of the Final Rule

MSHA estimates that penalties in the fifth year that the final rule is in effect, and every year thereafter, are \$16,500 for surface coal mine operators. Penalties for each mine size are shown below:

- \$7,256 in mines with 1-19 employees (8 citations x \$907 penalty charge per citation);
- \$8,078 in mines with 20-500 employees (7 citations x \$1,154 penalty charge per citation); and
- \$1,154 in mines with 501+ employees (1 citation x \$1,154 penalty charge per citation).

Under the final rule, the penalties for surface coal mines change each year until the fifth year after, which they remain constant. The Agency estimated penalties that will be incurred over a 10-year period by multiplying each year's penalties (excluding the penalties in the first year) by a discount factor. MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at annual penalty estimates of: \$11,022 for mines with 1-19 employees; \$11,575 for mines with 20-500 employees; and \$2,296 for mines with 501+ employees.

Table IV-19 shows annual penalties paid by underground and surface coal mine operators, by mine size. MSHA estimates the annual penalties paid as a result of the final rule to be \$864,300 for underground coal mine operators and \$24,900 for surface coal mine operators.

**Table IV-19: Annual Penalties
for Underground and Surface Coal Mine Operators**

Description	Penalties by Mine Size			
	1-19	20-500	501+	Total
Underground Coal Operators	\$32,977	\$670,861	\$160,463	\$864,300
Surface Coal Operators	\$11,022	\$11,575	\$2,296	\$24,894
Total	\$43,999	\$682,436	\$162,759	\$889,194

Costs for Corrective Actions When a Valid Representative Sample Meets or Exceeds the ECV, (but No Citation Is Issued)

When a valid representative sample meets or exceeds the Excessive Concentration Value (ECV) and no citation is issued under the final rule, operators must take immediate corrective action to lower the concentration of respirable dust to at or below the applicable respirable dust standard under final §§ 70.206(e)(2), 70.207(d)(2), 70.208(e)(2), and 70.209(c)(2) at underground coal mines, 71.206(h)(2) at surface coal mines, and 90.207(c)(2) for part 90 miners.

For surface coal operations, there is insufficient data to project the number of times a sample result would meet or exceed the ECV, but a citation would not be issued. Therefore, MSHA considered all overexposures in surface coal mines to result in a citation, and costs related to these citations were calculated earlier in this Chapter when deriving the abatement costs.

For underground coal mine operators, MSHA estimated the number of times operators will be required to take corrective action under the final rule when 1 out of 5 valid, representative operator samples in a sampling period, or 1 or 2 out of 15 valid, representative operator samples in a sampling period, meet or exceed the ECV, and then developed the associated costs.

Table IV-20 shows, by mine size, MSHA's estimate of the annual number of times underground coal mine operators must take corrective action when: 1 out of 5 valid, representative operator samples; or 1 or 2 out of 15 valid, representative operator samples, meets or exceeds the applicable ECV. Table A-18 in Appendix A of this REA is the source for the numbers in Table IV-20. These numbers increase each year up to the third year to reflect: the revised definition of normal production shift when sampling which occurs when the final rule is in effect; the required use of a sampling instrument (the CPDM) 18 months after the effective date of the final rule; an increase in the amount of sampling required when sampling with the CPDM; and the reduction in the respirable coal mine dust standard from 2.0 mg/m³ to 1.5 mg/m³ two years (24 months) after the final rule is in effect. After the third year, MSHA expects that operators will have gained experience in using the CPDM and will have adjusted to the revised definition of normal production shift and the lower respirable coal mine dust standard.

Table IV-20: Number of Occasions When Underground Coal Operators Must Take Corrective Action Due to Either 1 Out of 5 Valid Representative Samples or 1 or 2 Out of 15 Valid Representative Samples Meeting or Exceeding the ECV

Mine Size	Year 1	Year 2	Year 3	Year 4	Year 5 and Every Year Thereafter
1-19	179	253	378	269	237
20-500	1,617	2,296	3,544	2,497	2,188
501+	176	300	496	356	311
Total	1,972	2,849	4,418	3,122	2,736

The cost estimates below for implementing and recording corrective actions are based on the numbers in Table IV-20.

Implement Corrective Actions

As noted above, when a valid representative operator sample meets or exceeds the ECV and no citation is issued under the final rule, the underground coal mine operator shall immediately take corrective action to lower the concentration of respirable dust to or below the applicable respirable dust standard under: final §§ 70.206(e)(2), 70.207(d)(2), 70.208(e)(2), and 70.209(c)(2) for underground coal mine operators; and under § 90.207(c)(2) for part 90 miners. MSHA assumes that the corrective actions taken by underground coal mine operators could consist of: adjusting ventilation controls, such as regulators; adjusting water sprays; and changing sprays. As noted previously, the cost (including labor) for implementing a corrective

action is approximately \$250 in underground coal mines.

Underground Coal Mine Operators

First Year of the Final Rule

MSHA estimates that the costs to implement corrective actions in the first year that the final rule is in effect are \$493,000 for underground coal mine operators when 1 out of 5 valid representative samples meets or exceeds the applicable ECV. Costs for each mine size are shown below:

- \$44,750 in mines with 1-19 employees (179 corrective actions x \$250);
- \$404,250 in mines with 20-500 employees (1,617 corrective actions x \$250); and
- \$44,000 in mines with 501+ employees (176 corrective actions x \$250).

Second Year of the Final Rule

MSHA estimates that the costs to implement corrective actions in the second year that the final rule is in effect are \$712,250 for underground coal mine operators when 1 out of 5 valid, representative samples in a sampling period, or 1 or 2 out of 15 valid, representative samples in a sampling period, meets or exceeds the applicable ECV. Costs for each mine size are shown below:

- \$63,250 in mines with 1-19 employees (253 corrective actions x \$250);
- \$574,000 in mines with 20-500 employees (2,296 corrective actions x \$250); and
- \$75,000 in mines with 501+ employees (300 corrective actions x \$250).

Third Year of the Final Rule

MSHA estimates that the costs to implement corrective actions in the third year that the final rule is in effect are \$1.1 million for underground coal mine operators when 1 out of 5 valid, representative samples in a sampling period, or 1 or 2 out of 15 valid, representative samples in a sampling period, meets or exceeds the applicable ECV. Costs for each mine size are shown below:

- \$94,500 in mines with 1-19 employees (378 corrective actions x \$250);
- \$886,000 in mines with 20-500 employees (3,544 corrective actions x \$250); and
- \$124,000 in mines with 501+ employees (496 corrective actions x \$250).

Fourth Year of the Final Rule

MSHA estimates that the costs to implement corrective actions in the fourth year that the final rule is in effect are \$780,500 for underground coal mine operators when 1 out of 5 valid, representative samples in a sampling period, or 1 or 2 out of 15 valid, representative samples in a sampling period, meets or exceeds the applicable ECV. Costs for each mine size are shown below:

- \$67,250 in mines with 1-19 employees (269 corrective actions x \$250);
- \$624,250 in mines with 20-500 employees (2,497 corrective actions x \$250); and
- \$89,000 in mines with 501+ employees (356 corrective actions x \$250).

Fifth Year of the Final Rule and Every Year Thereafter

MSHA estimates that the costs to implement corrective actions in the fifth year, and every year thereafter, that the final rule is in effect are \$684,000 for underground coal mine

operators when 1 out of 5 valid, representative samples in a sampling period, or 1 or 2 out of 15 valid, representative samples in a sampling period, meets or exceeds the applicable ECV. Costs for each mine size are shown below:

- \$59,250 in mines with 1-19 employees (237 corrective actions x \$250);
- \$547,000 in mines with 20-500 employees (2,188 corrective actions x \$250); and
- \$77,750 in mines with 501+ employees (311 corrective actions x \$250).

Under the final rule, the cost of implementing corrective actions in underground coal mines changes each year until the fifth year, after which it remains constant. The Agency estimated costs that will be incurred over a 10-year period by multiplying each year's costs (excluding the costs in the first year) by a discount factor. MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at annual cost estimates of: \$66,987 for mines with 1-19 employees; \$617,928 for mines with 20-500 employees; and \$84,838 for mines with 501+ employees.

Record and Certify Corrective Actions

A record of corrective actions must be made and certified under final §§ 70.206(e)(3), 70.207(d)(3), 70.208(e)(3), 70.209(c)(3) at underground coal mines and 90.207(c)(3) for part 90 miners, when 1 out of 5 valid, representative samples in a sampling period, or 1 or 2 out of 15 valid, representative samples in a sampling period, meets or exceeds the applicable ECV. MSHA estimates that, on average, it takes 12 minutes (0.2 hours) to make a record of corrective actions and certify the record. MSHA assumes that a supervisory person, earning \$84.69 per hour in an underground coal mine, will make the record; and a mine foreman or equivalent mine official that certifies the record earns the same supervisory hourly wage rate.

Underground Coal Mine Operators

First Year of the Final Rule

MSHA estimates that the costs to make a record of the corrective actions and certify the record in the first year that the final rule is in effect are \$33,425 for underground coal mine operators when 1 out of 5 valid representative samples meets or exceeds the applicable ECV. Costs for each mine size are shown below:

- \$3,032 in mines with 1-19 employees (179 records x 0.2 hrs. x \$84.69 hourly wage rate);
- \$27,389 in mines with 20-500 employees (1,617 records x 0.2 hrs. x \$84.69 hourly wage rate); and
- \$2,981 in mines with 501+ employees (176 records x 0.2 hrs. x \$84.69 hourly wage rate).

Second Year of the Final Rule

MSHA estimates that the costs to make a record of the corrective actions and certify the record in the second year that the final rule is in effect are \$48,275 for underground coal mine operators when 1 out of 5 valid, representative samples in a sampling period, or 1 or 2 out of 15 valid, representative samples in a sampling period, meets or exceeds the applicable ECV. Costs for each mine size are shown below:

- \$4,285 in mines with 1-19 employees (253 records x 0.2 hrs. x \$84.69 hourly wage rate);
- \$38,890 in mines with 20-500 employees (2,296 records x 0.2 hrs. x \$84.69 hourly wage rate); and
- \$5,081 in mines with 501+ employees (300 records x 0.2 hrs. x \$84.69 hourly wage rate).

Third Year of the Final Rule

MSHA estimates that the costs to make a record of the corrective actions and certify the record in the third year that the final rule is in effect are \$74,850 for underground coal mine operators when 1 out of 5 valid, representative samples in a sampling period, or 1 or 2 out of 15 valid, representative samples in a sampling period, meets or exceeds the applicable ECV. Costs for each mine size are shown below:

- \$6,403 in mines with 1-19 employees (378 records x 0.2 hrs. x \$84.69 hourly wage rate);
- \$60,028 in mines with 20-500 employees (3,544 records x 0.2 hrs. x \$84.69 hourly wage rate); and
- \$8,401 in mines with 501+ employees (496 records x 0.2 hrs. x \$84.69 hourly wage rate).

Fourth Year of the Final Rule

MSHA estimates that the costs to make a record of the corrective actions and certify the record in the fourth year that the final rule is in effect are \$52,900 for underground coal mine operators when 1 out of 5 valid, representative samples in a sampling period, or 1 or 2 out of 15 valid, representative samples in a sampling period, meets or exceeds the applicable ECV. Costs for each mine size are shown below:

- \$4,556 in mines with 1-19 employees (269 records x 0.2 hrs. x \$84.69 hourly wage rate);
- \$42,294 in mines with 20-500 employees (2,497 records x 0.2 hrs. x \$84.69 hourly wage rate); and
- \$6,030 in mines with 501+ employees (356 records x 0.2 hrs. x \$84.69 hourly wage rate).

Fifth Year of the Final Rule and Every Year Thereafter

MSHA estimates that the costs to make a record of the corrective actions and certify the record in the fifth year that the final rule is in effect, and every year thereafter, are \$46,350 for underground coal mine operators when 1 out of 5 valid, representative samples in a sampling period, or 1 or 2 out of 15 valid, representative samples in a sampling period, meets or exceeds the applicable ECV. Costs for each mine size are shown below:

- \$4,014 in mines with 1-19 employees (237 records x 0.2 hrs. x \$84.69 hourly wage rate);
- \$37,060 in mines with 20-500 employees (2,188 records x 0.2 hrs. x \$84.69 hourly wage rate); and

- \$5,268 in mines with 501+ employees (311 records x 0.2 hrs. x \$84.69 hourly wage rate).

Under the final rule, the cost to make a record of the corrective actions and certify the record in underground coal mines changes each year until the fifth year, after which it remains constant. The Agency estimated costs that will be incurred over a 10-year period by multiplying each year's costs (excluding the costs in the first year) by a discount factor. MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at annual cost estimates of: \$4,539 for mines with 1-19 employees; \$44,758 for mines with 20-500 employees; and \$6,169 for mines with 501+ employees.

Delayed Production

Under proposed § 70.208(f) and (g), operators would have needed to “implement corrective actions to assure compliance with the applicable standard on the next shift and other subsequent production shifts” when: a valid end-of-shift equivalent concentration met or exceeded the applicable Excessive Concentration Value (ECV); a weekly accumulated exposure exceeded the weekly permissible accumulated exposure; or a valid end-of-shift concentration exceeded the applicable standard but was less than the applicable ECV value.

Commenters stated that these proposed standards would have caused substantial revenue losses from production delays because operators would need to interrupt production to implement corrective actions before the next shift. One commenter estimated that the revenue losses from these proposed standards would result in \$1.8 billion per year for underground coal mine operators, while another commenter estimated the revenue losses at \$30.2 million for a particular underground coal mine. Other commenters stated that the proposed standard would have resulted in significant production delays because it takes considerable time to get corrective actions approved by MSHA and implemented in a mine.

The final rule requires that when 1 out of 5 valid, representative samples in a sampling period, or 1 or 2 out of 15 valid, representative samples in a sampling period meet or exceed the ECV, operators must take immediate corrective action to lower the concentration of respirable dust to at or below the applicable respirable dust standard under §§ 70.206(e)(2), 70.207(d)(2), 70.208(e)(2), and 70.209(c)(2) at underground coal mines, 71.206(h)(2) at surface coal mines, and 90.207(c)(2) for part 90 miners.

MSHA will assess, on a case-by-case basis, the action that must be taken immediately and the appropriate timeframe within which it must occur. For example, circumstances involving a relatively minor correction, “immediately” would mean before the next shift. Under circumstances involving the purchase of additional equipment or parts, MSHA will accept a bona fide purchase order as addressing the corrective action immediately. The purchase order must show the date of purchase and expected delivery, and the equipment or part must be installed as soon as it is delivered.

Therefore, MSHA assumes that when underground coal mine operators need to take corrective actions due to 1 out of 5 valid, representative samples in a sampling period, or 1 or 2 out of 15 valid, representative samples in a sampling period, meeting or exceeding the ECV, a

delay in production will not occur because the corrective action will be taken during the shift, between shifts, or on maintenance shifts.

Table IV-21 shows annual costs for corrective actions for underground coal mine operators, by mine size, when a valid representative sample meets or exceeds the ECV and no citation is incurred. MSHA estimates annual costs are \$825,225.

Table IV-21: Annual Cost Estimates Related to Underground Coal Mine Operators Taking Corrective Actions When 1 Out of 5 Valid Representative Samples, or 1 or 2 out of 15 Valid Representative Samples Meet or Exceed the Applicable ECV

Description	Operators by Employment Size			
	1-19	20-500	501+	Total
Underground Coal Operators				
Implement Corrective Actions	\$66,987	\$617,928	\$84,838	\$769,754
Record & Certify Corrective Actions	\$4,539	\$44,758	\$6,169	\$55,465
Total Underground	\$71,526	\$662,686	\$91,007	\$825,219

Persons Certified in the Use of Sampling Equipment

Sampling by Certified Persons

MSHA estimates no costs for final §§ 70.202(a), 71.202(a), and 90.202(a). Costs to certify additional persons for sampling resulting from the final rule are presented below.

Certification to Sample

Final §§ 70.202(b), 71.202(b), and 90.202(b) retain the existing requirements that candidates for certification pass an MSHA examination to demonstrate competency in respirable dust sampling procedures. To assure consistent administration of the certification process, however, the final rule adds a requirement that candidates complete an MSHA course of instruction prior to certification. MSHA will provide the course of instruction at no charge. However, MSHA assumes that persons will travel to either an MSHA district or field office to take the course.

Under the final rule, persons who will take samples must be certified to perform sampling. Persons who are currently certified to sample using the gravimetric sampler will not be required to take the course of instruction. Currently, there is a sufficient number of persons certified to perform the required gravimetric sampling at all underground coal mines. Twenty percent of surface coal mines have certified persons to perform gravimetric sampling. Under the final rule, all mines that will use the CPDM will need persons to be trained and certified to perform CPDM sampling.

Below, MSHA estimates the number of persons needing certification in sampling and maintenance and calibration as a result of the final rule.

Estimate of the Number of Certified Persons to Sample at Underground Coal Mines

In the PREA, MSHA estimated that there were a sufficient number of persons certified to sample with a gravimetric sampler at underground coal mines, and therefore, at those mines only costs related to certifying persons to conduct CPDM sampling were estimated. In the PREA, MSHA estimated that 1 person per MMU per shift would need to be certified to sample with the CPDM. MSHA also estimated in the PREA that an additional person per underground coal mine with 20 or more employees would have to be certified for other designated occupation (ODO) sampling on MMUs and designated area (DA) sampling in outby areas. Finally, MSHA estimated that another person would have to be certified to sample facilities on the surface of underground coal mines (such as a preparation plant, a mill, shop or yard).

A commenter stated that because of the extensive requirements for sampling with the CPDM under the proposed rule, 3 new safety technicians certified in dust sampling and maintenance would be needed per underground coal mine. Another commenter was concerned that additional safety technicians would be needed to meet the requirements of the proposed rule. In response to comments, MSHA revised its estimate to 2 persons per MMU, per shift, that will need to be certified to sample with the CPDM. In addition, MSHA also estimates that each underground coal mine will need 1 additional person certified for sampling with CPDMs. Since the certified persons on each MMU on each shift are likely to stay underground during the shift, MSHA expects that the additional person receiving certification per mine will be responsible for preshift setup of CPDMs and sampling the relatively few part 90 miners that work on surface areas of underground coal mines.

As was done for the PREA, MSHA did not estimate that additional workers might be hired by operators to be certified to perform sampling and maintenance with the CPDM. Some commenters questioned MSHA's cost estimates for the proposed CPDM requirements noting that those estimates were too low because they did not account for the additional workers that would have to be hired to comply with the proposed monitoring requirements. Consistent with standard regulatory costing practices, the Agency estimated the additional time and cost that would be needed to comply with the requirements. In some cases the additional requirements will be performed by existing workers, while in other cases additional persons may be hired to perform the work. For example, under the final rule, sampling with the CPDM will replace sampling with the gravimetric sampler for various occupations. Persons certified in sampling with the gravimetric sampler can be certified to use the CPDM, and time previously spent preparing and sampling with the gravimetric sampler can be shifted to those occupations that will be sampled by the CPDM rather than the gravimetric sampler. While MSHA did not provide cost estimates for the impact of the final rule on the overall staffing levels in the coal mining industry, the additional time and associated labor costs needed to certify persons to sample with and maintain CPDMs are accounted for in MSHA's estimates.

The 81 MMUs in mines with 1-19 employees are assumed to operate 1 shift per day. On average, the 708 MMUs in mines with 20-500 employees and the 92 MMUs in mines with 501+ employees are assumed to operate 2 shifts per day. MSHA estimates that the number of additional persons that underground coal mine operators need to have certified is 3,786 persons, of which:

- 243 additional persons to be certified in mines with 1-19 employees [(81 MMUs x 1 shift per day x 2 persons per shift) + (81 mines x 1 person per mine)];
- 3,163 additional persons to be certified in mines with 20-500 employees [(708 MMUs x 2 shifts per day x 2 persons per shift) + (331 mines x 1 person per mine)]; and
- 380 additional persons to be certified in mines with 501+ employees [(92 MMUs x 2 shifts x 2 persons per shift) + (12 mines x 1 person per mine)].

Estimate of the Number of Certified Persons to Sample at Surface Coal Mines

There were no comments specific to MSHA's estimate of the number of persons that will have to be certified to sample at surface coal mines. Therefore, MSHA made no changes to the estimates used in the PREA.

Surface coal mines currently sample approximately 320 designated work positions (DWP) at approximately 225 mines. This represents approximately 20 percent of all surface coal mines. Under the final rule, surface coal mine operators have the option to use either a gravimetric sampler or a CPDM to conduct DWP sampling. When the final rule is in effect, MSHA assumes that surface coal mine operators will choose to conduct sampling using the less expensive gravimetric sampler unless they have part 90 miners who must be sampled using a CPDM.¹⁰ Therefore, 80 percent of surface coal mines (898 mines) that currently do not sample will need persons to take the applicable course and examination required by final § 71.202(b) to be certified. In addition, MSHA expects that the 20 percent of surface coal mines that currently are sampling will each need additional certified persons to perform sampling because of the increased sampling required under the final rule (e.g., final § 71.206(c) establishes more DWPs than are currently designated).

MSHA estimates that the 898 surface coal mines that currently do not conduct sampling will need certifications for: 2 persons at each mine with 1-19 employees; 3 persons at each mine with 20-500 employees; and 6 persons at each mine with 501+ employees. MSHA estimates that the 225 surface coal mines that currently conduct sampling have an average of 2 persons per mine that are certified to sample and will need 1 additional person certified in sampling for each mine with 20-500 employees, and 4 additional persons certified in sampling for each mine with 501+ employees. No additional certified persons will be needed for surface coal mines that currently conduct sampling and have 1-19 employees. MSHA estimates that the number of additional persons that surface coal mine operators need to be certified in sampling is:

- 992 additional persons to be certified in mines with 1-19 employees (620 surface coal mines x 80 percent x 2 persons);
- 1,297 additional persons to be certified in mines with 20-500 employees [(499 surface coal mines x 80 percent x 3 persons) + (499 surface coal mines x 20 percent x 1 person)]; and
- 22 additional persons to be certified in mines with 501+ employees [(4 surface coal mines x 80 percent x 6 persons) + (4 surface coal mines x 20 percent x 4 persons)].

¹⁰ Since surface coal miners are not currently eligible for the Part 90 program, MSHA placed all of the costs related to sampling Part 90 miners with the CPDM at surface coal mines, including those related to certifying persons to sample, under the section in Chapter IV of this REA analysis, titled "Extension of Part 90 Option to Miners at Surface Coal Mines". Final § 90.1 extends the scope of the Part 90 option to surface coal miners.

Cost Estimates to Certify Persons to Sample

Although sampling with the CPDM is not required until 18 months after the effective date of the final rule, this analysis assumes that operators will certify persons to sample during the first year that the final rule is in effect. MSHA assumes that a sufficient number of persons employed at underground coal mines are certified to sample with the gravimetric sampler; however, persons will need to be certified to sample with the CPDM. Persons employed at surface coal mines will be certified to sample with the gravimetric sampler. MSHA estimates that it takes a person 9 hours to complete the CPDM course and examination on sampling (7 hours for the course, 1 hour for the examination, and 1 hour to travel to and from the course site); and 3.5 hours for the course and examination on sampling with the gravimetric sampler (2 hours for the course, 0.5 hours for the exam, 1 hour to travel to and from the course site). MSHA estimates that a person certified for sampling earns \$33.23 per hour in an underground coal mine and \$28.13 per hour in a surface coal mine. MSHA estimates that the travel expenses average \$50 per round trip.

MSHA estimates that first year costs to certify additional persons to sample are: \$1.3 million for underground coal mine operators and \$342,100 for surface coal mine operators. Costs for each mine size are shown below:

Underground Coal Mine Operators:

- \$84,824 in mines with 1-19 employees [243 additional persons to be certified x ((9 hrs. for course, examination and travel x \$33.23 hourly wage rate) + \$50 travel expenses)];
- \$1,104,108 in mines with 20-500 employees [3,163 additional persons to be certified x ((9 hrs. for course, examination and travel x \$33.23 hourly wage rate) + \$50 travel expenses)]; and
- \$132,647 in mines with 501+ employees [380 additional persons to be certified x ((9 hrs. for course, examination and travel x \$33.23 hourly wage rate) + \$50 travel expenses)].

Surface coal mine operators:

- \$147,267 in mines with 1-19 employees [992 additional persons to be certified x ((3.5 hrs. for course, examination and travel x \$28.13 hourly wage rate) + \$50 travel expenses)];
- \$192,546 in mines with 20-500 employees [1,297 additional persons to be certified x ((3.5 hrs. for course, examination and travel x \$28.13 hourly wage rate) + \$50 travel expenses)]; and
- \$3,266 in mines with 501+ employees [22 additional persons to be certified x ((3.5 hrs. for course, examination and travel x \$28.13 hourly wage rate) + \$50 travel expenses)].

First year cost estimates were annualized over 10 years by multiplying them by a factor of 0.142 based on a 7 percent discount rate to arrive at an annualized cost estimate of \$187,600 for underground coal mine operators and \$48,775 for surface coal mine operators.

Turnover Cost Estimates to Certify Persons to Sample

There are occasions when persons certified to sample leave the job and have to be replaced or a new mine starting up will need certified persons. In some instances, a replacement will have already been certified to perform the required sampling. However, in other instances, a replacement will need to be certified. MSHA estimates a turnover rate of 6 percent of the certified persons in underground coal mines and 3 percent of the certified persons in surface coal mines. MSHA assumes that a replacement at underground coal mines will be certified during the same one-day training session to sample with both the gravimetric sampler and CPDM; for this reason, MSHA estimates one hour of travel time. A replacement at surface coal mines will be certified only to sample with the gravimetric sampler. MSHA assumes that turnover costs will occur annually (including the first year the rule is in effect).

For underground coal mines, MSHA estimates that it takes 11.5 hours to certify each replacement (7 hours for the CPDM course, 1 hour for the examination, 2 hours for the gravimetric course, 0.5 hours for the exam, and 1 hour to travel to and from the course site). For surface coal mines, MSHA estimates that it takes 3.5 hours to certify each replacement (2 hours for the gravimetric course, 0.5 hours for the exam, and 1 hour for travel to and from the course site).

MSHA estimates that annual costs to certify replacements to sample are \$98,500 for underground coal mine operators and \$10,400 for surface coal mine operators. Costs for each mine size are shown below:

Underground Coal Mine Operators:

- \$6,482 in mines with 1-19 employees [15 additional persons to be certified x ((11.5 hrs. for courses, examinations and travel x \$33.23 hourly wage rate) + \$50 travel expenses)];
- \$82,108 in mines with 20-500 employees [190 additional persons to be certified x ((11.5 hrs. for courses, examinations and travel x \$33.23 hourly wage rate) + \$50 travel expenses)]; and
- \$9,939 in mines with 501+ employees [23 additional persons to be certified x ((11.5 hrs. for courses, examinations and travel x \$33.23 hourly wage rate) + \$50 travel expenses)].

Surface Coal Mine Operators:

- \$4,454 in mines with 1-19 employees [30 additional persons to be certified x ((3.5 hrs. for course, examination and travel x \$28.13 hourly wage rate) + \$50 travel expenses)];
- \$5,790 in mines with 20-500 employees [39 additional persons to be certified x ((3.5 hrs. for course, examination and travel x \$28.13 hourly wage rate) + \$50 travel expenses)]; and
- \$148 in mines with 501+ employees [1 additional person to be certified x ((3.5 hrs. for course, examination and travel x \$28.13 hourly wage rate) + \$50 travel expenses)].

Examination to Maintain Certification to Sample

Final §§ 70.202(c), 71.202(c) and 90.202(c) require persons certified in dust sampling procedures to pass the MSHA examination every three years to demonstrate competency in sampling procedures. Persons that pass the examination maintain their certification. Persons that fail the examination must retake the examination and pass it to maintain their certification.

Estimate of the Number of Persons Taking Examination

The number of persons in underground coal mines required to take the MSHA examination to maintain certification to sample is the same as those estimated earlier to be certified to sample with the CPDM under final § 70.202(b). There are 243 persons in mines with 1-19 employees; 3,163 persons in mines with 20-500 employees; and 380 persons in mines with 501+ employees. For surface coal mines, persons certified to sample with the gravimetric sampler under final § 71.202(b), as well as persons holding certifications to sample with the gravimetric sampler when the rule takes effect, will need to take the certification examination every three years. MSHA estimates that the number of persons in surface coal mines that need to take an MSHA examination to maintain their certification to sample are: 1,240 persons in mines with 1-19 employees (620 mines x 2 persons); 1,497 persons in mines with 20-500 employees (499 mines x 3 persons); and 24 persons in mines with 501+ employees (4 mines x 6 persons).

It was not possible for MSHA to estimate when persons will have to be recertified. For example, MSHA assumed that for underground coal mines all new certifications resulting from the final rule will occur in the first year that the rule is in effect. Some may be certified before the final rule takes effect, and some may wait until the second year when the requirement for monitoring with the CPDM takes effect.

Due to the difficulty of determining when persons will take the examination to be recertified, and that some may be recertified earlier than required, MSHA assumed that one-third of the certified persons will take the recertification examination each year. Therefore, for each mine size, the number of persons taking the examination each year to maintain certification is:

Underground Coal Mine Operators:

- 81 persons taking examinations in mines with 1-19 employees (243 persons /3);
- 1,054 persons taking examinations in mines with 20-500 employees (3,163 persons /3); and
- 127 persons taking examinations in mines with 501+ employees (380 persons /3).

Surface Coal Mine Operators:

- 413 persons taking examinations in mines with 1-19 employees (1,240 persons /3);
- 499 persons taking examinations in mines with 20-500 employees (1,497 persons /3); and
- 8 persons taking examinations in mines with 501+ employees (24 persons /3).

Cost Estimates to Take Examination to Maintain Certification to Sample

For underground coal mines, MSHA estimates that the examination to maintain certification to perform sampling takes 2.5 hours (1 hour for the CPDM examination, 0.5 hours for the gravimetric examination, and 1 hour to travel to and from the site). For surface coal

mines, MSHA estimates that the examination to maintain certification to perform sampling takes 1.5 hours (0.5 hours for the gravimetric examination and 1 hour to travel to and from the site).

MSHA assumes that all persons from underground coal mines will take both the CPDM and gravimetric certification examinations. For underground coal mines, this assumption is likely to result in a slight overestimate of the examination costs for re-certification because a small number of persons may be certified on only one device and take only one exam. For example, after the requirement to sample the DOs and ODOs with the CPDM is in effect, underground coal mines will need fewer persons certified to use the gravimetric sampler. As a result, not every certified person working underground will need to pass the examination for the gravimetric sampler. This slight overestimation for underground coal mines will be offset by additional hours needed for travel if different persons take each exam. All certified persons from surface coal mines are assumed to take only the gravimetric examination.

MSHA estimates that annual costs for certified persons to take the examination to maintain certification to sample are \$167,900 for underground coal mine operators and \$84,825 for surface coal mine operators. Costs for each mine size are shown below:

Underground Coal Mine Operators:

- \$10,779 in mines with 1-19 employees [81 persons taking examinations x ((2.5 hrs. for examinations and travel x \$33.23 hourly wage rate) + \$50 travel expenses)];
- \$140,261 in mines with 20-500 employees [1,054 persons taking examinations x ((2.5 hrs. for examinations and travel x \$33.23 hourly wage rate) + \$50 travel expenses)]; and
- \$16,901 in mines with 501+ employees [127 persons taking examinations x ((2.5 hrs. for examinations and travel x \$33.23 hourly wage rate) + \$50 travel expenses)].

Surface Coal Mine Operators:

- \$38,077 in mines with 1-19 employees [413 persons taking examinations x ((1.5 hrs. for examination and travel x \$28.13 hourly wage rate) + \$50 travel expenses)];
- \$46,005 in mines with 20-500 employees [499 persons taking examinations x ((1.5 hrs. for examination and travel x \$28.13 hourly wage rate) + \$50 travel expenses)]; and
- \$738 in mines with 501+ employees [8 persons taking examinations x ((1.5 hrs. for examination and travel x \$28.13 hourly wage rate) + \$50 travel expenses)].

Cost Estimates for Persons to Retake Examinations to Maintain Certification to Sample

Some persons taking the examination to maintain their certification to sample will fail the examination and take the examination again. MSHA assumes that 10 percent of the certified persons who work at underground coal mines and 5 percent of the certified persons who work at surface coal mines will retake the examination to be certified. The time required to take the examination is the same as determined above.

For underground coal mines, MSHA estimates the time to take the examination to be recertified for sampling with the CPDM to be 2 hours (1 hour to take the examination and 1 hour of travel time. For surface coal mines, MSHA estimates the time to take the examination to

recertify for sampling with the gravimetric sampler to be 1.5 hours (0.5 hours to take the examination and 1 hour of travel time).

MSHA estimates that the annual costs for persons who failed the examination and retake it are \$14,675 for underground coal mine operators and \$4,350 for surface coal mine operators. Costs for each mine size are shown below:

Underground Coal Mine Operators:

- \$932 in mines with 1-19 employees [8 persons retaking examination x ((2 hrs. for examination and travel x \$33.23 hourly wage rate) + \$50 travel expenses)];
- \$12,228 in mines with 20-500 employees [105 persons retaking examination x ((2 hrs. for examination and travel x \$33.23 hourly wage rate) + \$50 travel expenses)]; and
- \$1,514 in mines with 501+ employees [13 persons retaking examination x ((2 hrs. for examination and travel x \$33.23 hourly wage rate) + \$50 travel expenses)].

Surface Coal Mine Operators:

- \$1,936 in mines with 1-19 employees [21 persons retaking examination x ((1.5 hrs. for examination and travel x \$28.13 hourly wage rate) + \$50 travel expense)];
- \$2,305 in mines with 20-500 employees [25 persons retaking examination x ((1.5 hrs. for examination and travel x \$28.13 hourly wage rate) + \$50 travel expense)]; and
- \$92 in mines with 501+ employees [1 person retaking examination x ((1.5 hrs. for examination and travel x \$28.13 hourly wage rate) + \$50 travel expense)].

Persons Certified in Maintaining and Calibrating Sampling Equipment

Maintenance and Calibration by Certified Persons

MSHA estimates no costs for final §§ 70.203(a), 71.203(a), and 90.203(a). Costs to certify additional persons for maintenance and calibration resulting from the final rule are presented below.

Certification to Maintain and Calibrate Sampling Equipment

For underground coal mine operators, final § 70.203(b) requires a person to complete an MSHA course of instruction and pass an MSHA examination to be certified to maintain and calibrate approved sampling equipment. Like the certification to perform sampling, MSHA will provide this course at no charge; however, persons will have to travel to either an MSHA district or field office to take the course. Estimates for the number of persons that need to be certified to perform maintenance and calibration on sampling equipment due to the final rule are shown below.

Estimate of the Number of Certified Persons to Maintain and Calibrate Sampling Equipment at Underground Coal Mines

Since all underground coal mines currently use the gravimetric sampler and are maintaining and calibrating the equipment, no additional persons will be needed at underground coal mines to maintain and calibrate the gravimetric sampler. In the PREA, MSHA estimated that, for underground mines, the number of persons needing certification to maintain and

calibrate the CPDM was: 1 person for each mine with 1-19 employees; 1 person for each mine with 20-500 employees; and 2 persons for each mine with 501+ employees. Due to commenters' concerns about sampling in underground coal mines, MSHA is revising its estimate. In this analysis, MSHA estimates that, for underground mines, the number of persons needing certification to maintain and calibrate the CPDM is: 1 person for each mine with 1-19 employees; and 2 persons for each mine with 20 or more employees.

- 81 additional persons to certify to maintain and calibrate the CPDM in mines with 1-19 employees (81 mines x 1 person per mine);
- 662 additional persons to certify to maintain and calibrate the CPDM in mines with 20-500 employees (331 mines x 2 persons per mine); and
- 24 additional persons to certify to maintain and calibrate the CPDM in mines with 501+ employees (12 mines x 2 persons per mine).

Estimate of the Number of Certified Persons to Maintain and Calibrate Sampling Equipment at Surface Coal Mines

As noted above, MSHA assumes that surface coal mines will not sample with a CPDM unless they have part 90 miners.¹¹ In the PREA, MSHA estimated that the 225 surface coal mines that currently sample with the gravimetric sampler were not expected to need additional persons to be certified to maintain and calibrate that device. Also, MSHA assumed that each of the 898 surface coal mines (80 percent of surface coal mines) that currently do not sample will need 1 person to be certified to maintain and calibrate the gravimetric sampler. Since MSHA received no comments on its estimate, the estimates remain the same in this analysis.

- 496 additional persons to certify to maintain and calibrate the gravimetric sampler in mines with 1-19 employees (620 mines x 80 percent x 1 person per mine);
- 399 additional persons to certify to maintain and calibrate the gravimetric sampler in mines with 20-500 employees (499 mines x 80 percent x 1 person per mine); and
- 3 additional persons to certify to maintain and calibrate the gravimetric sampler in mines with 501+ employees (4 mines x 80 percent x 1 person per mine).

Cost Estimates to Certify Persons to Maintain and Calibrate Sampling Equipment

Although sampling with the CPDM is not required until 18 months after the effective date of the final rule, this analysis assumes that operators will certify persons to maintain and calibrate sampling equipment during the first year that the final rule is in effect. MSHA estimates that a person needs 9 hours to take the CPDM course and examination on maintenance and calibration (7 hours for the course, 1 hour for the examination and 1 hour to travel to and from the course site). Also, MSHA estimates that a person needs 6 hours to take the course and examination on maintenance and calibration for the gravimetric sampler (4 hours for the course,

¹¹ Since surface coal miners are not currently eligible for the Part 90 program, MSHA placed all of the costs related to sampling Part 90 miners with the CPDM at surface coal mines, including those related to maintaining and calibrating sampling equipment, under the section in Chapter IV of this REA analysis, titled "Extension of Part 90 Option to Miners at Surface Coal Mines". Final § 90.1 extends the scope of the Part 90 option to surface coal miners.

1 hour for the exam, 1 hour to travel to and from the course site). MSHA estimates that a certified person earns \$33.23 per hour in an underground coal mine and \$28.13 in a surface coal mine. MSHA estimates that first year costs to certify persons to maintain and calibrate sampling equipment are \$267,700 for underground coal mine operators and \$196,475 for surface coal mine operators. Costs for each mine size are shown below:

Underground Coal Mine Operators:

- \$28,275 in mines with 1-19 employees [81 additional persons to be certified x ((9 hrs. for course, examination and travel x \$33.23 hourly wage rate) + \$50 travel expenses)];
- \$231,084 in mines with 20-500 employees [662 additional persons to be certified x ((9 hrs. for course, examination and travel x \$33.23 hourly wage rate) + \$50 travel expenses)]; and
- \$8,378 in mines with 501+ employees [24 additional persons to be certified x ((9 hrs. for course, examination and travel x \$33.23 hourly wage rate) + \$50 travel expenses)].

Surface Coal Mine Operators:

- \$108,515 in mines with 1-19 employees [496 additional persons to be certified x ((6 hrs. for course, examination and travel x \$28.13 hourly wage rate) + \$50 travel expenses)];
- \$87,293 in mines with 20-500 employees [399 additional persons to be certified x ((6 hrs. for course, examination and travel x \$28.13 hourly wage rate) + \$50 travel expenses)]; and
- \$656 in mines with 501+ employees [3 additional persons to be certified x ((6 hrs. for course, examination and travel x \$28.13 hourly wage rate) + \$50 travel expenses)].

First year cost estimates were annualized over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at an annualized cost estimate of \$38,000 for underground coal mine operators and \$27,900 for surface coal mine operators.

Turnover Cost Estimates to Certify Persons to Maintain and Calibrate Sampling Equipment

There are occasions when persons certified to maintain and calibrate sampling equipment will leave the job and have to be replaced or a new mine starting up will need certified persons. MSHA assumes the same replacement rates for persons certified to maintain and calibrate the sampling equipment as those for certifying persons to perform sampling that were noted above, 6 percent at underground coal mines and 3 percent at surface coal mines. MSHA assumes that turnover costs will occur annually (including the first year the rule is in effect).

For underground coal mines, MSHA assumes that persons will be certified on how to perform maintenance and calibration on both the gravimetric and CPDM sampling equipment. Thus, MSHA estimates that the time to certify replacements in underground coal mines is 15 hours, which consist of: 9 hours for the first day (8 hours for the CPDM course and examination + 1 hour of travel time to and from the course site); and 6 hours for the second day (5 hours for the gravimetric course and examination + 1 hour for travel to and from the course

site). MSHA estimates travel costs to be \$100 for the two days (\$50 per day). MSHA estimates that the number of persons to train are: 5 persons in mines with 1-19 employees (81 persons x 6 percent); 40 persons in mines with 20-500 employees (662 persons x 6 percent); and 1 person in mines with 501+ employees (24 persons x 6 percent).

For surface coal mines, MSHA assumes that persons will be certified only on how to perform maintenance and calibration on the gravimetric sampling device unless the mine has part 90 miners. Thus, MSHA estimates that the time to certify replacement persons in surface coal mines is 6 hours (5 hours for the course and exam, and 1 hour for travel to and from the course site). MSHA estimates that operators will need to train: 15 persons in mines with 1-19 employees (496 persons x 3 percent); 12 persons in mines with 20-500 employees (399 persons x 3 percent); and 1 person in mines with 501+ employees (3 persons x 3 percent).

MSHA estimates that annual costs to certify replacements to maintain and calibrate sampling equipment are \$27,500 for underground coal mine operators and \$6,100 for surface coal mine operators. Costs for each mine size are shown below:

Underground Coal Mine Operators:

- \$2,992 in mines with 1-19 employees [5 additional persons to be certified x ((15 hrs. for course, examination and travel x \$33.23 hourly wage rate) + \$100 travel expenses)];
- \$23,938 in mines with 20-500 employees [20 additional persons to be certified x ((15 hrs. for course, examination and travel x \$33.23 hourly wage rate) + \$100 travel expenses)]; and
- \$598 in mines with 501+ employees [1 additional person to be certified x ((15 hrs. for course, examination and travel x \$33.23 hourly wage rate) + \$100 travel expenses)].

Surface Coal Mine Operators:

- \$3,282 in mines with 1-19 employees [15 additional persons to be certified x ((6 hrs. for course, examination and travel x \$28.13 hourly wage rate) + \$50 travel expenses)];
- \$2,625 in mines with 20-500 employees [12 additional persons to be certified x ((6 hrs. for course, examination and travel x \$28.13 hourly wage rate) + \$50 travel expenses)]; and
- \$219 in mines with 501+ employees [1 additional person to be certified x ((6 hrs. for course, examination and travel x \$28.13 hourly wage rate) + \$50 travel expenses)].

Examination to Maintain Certification to Perform Maintenance and Calibration on Sampling Equipment

Final §§ 70.203(c), 71.203(c) and 90.203(c) require persons certified in dust sampling procedures to pass the MSHA examination demonstrating competency in sampling procedures or maintenance and calibration procedures every three years. Persons who pass the examination maintain their certification. Persons who fail the examination must retake it to be re-certified.

Estimate of the Number of Persons Taking Examination

For underground coal mines, the number of certified persons who will need to take the

MSHA examination to keep their certification to maintain and calibrate sampling equipment are the same as the estimates above to be certified under final § 70.203(b): 81 persons in mines with 1-19 employees; 662 persons in mines with 20-500 employees; and 24 persons in mines with 501+ employees. For surface coal mines, MSHA assumed that all mines will need to have a person take the examination to keep his or her certification to maintain and calibrate sampling equipment. Thus, the number of persons taking the examination is equal to the number of surface coal mines: 620 persons in mines with 1-19 employees; 499 persons in mines with 20-500 employees; and 4 persons in mines with 501+ employees.

As explained above in the discussion of maintaining certification of persons for sampling, due to the difficulty of determining exactly when persons will take the examination to recertify, and the fact that some persons may take the examination to maintain certification earlier than required, MSHA assumes that one-third of the persons who are certified to perform sampling will take the certification examination each year. MSHA estimates that the number of persons taking the examination each year to maintain their certification is:

Underground Coal Mine Operators:

- 27 persons taking examinations in mines with 1-19 employees (81 persons /3);
- 221 persons taking examinations in mines with 20-500 employees (662 persons /3); and
- 8 persons taking examinations in mines with 501+ employees (24 persons /3).

Surface Coal Mine Operators:

- 207 persons taking examinations in mines with 1-19 employees (620 persons /3);
- 166 persons taking examinations in mines with 20-500 employees (499 persons /3); and,
- 1 person taking examination in mines with 501+ employees (4 persons /3).

Cost Estimates to Take Examination to Maintain Certification to Perform Maintenance and Calibration on Sampling Equipment

For underground coal mines, MSHA estimates that the examination to maintain certification to perform maintenance and calibration on sampling equipment will take 3 hours (1 hour for the CPDM examination, 1 hour for the gravimetric examination, and 1 hour to travel to and from the site where the examination is given). For surface coal mines, MSHA estimates that it will take 2 hours to take the examination to perform maintenance and calibration on sampling equipment (1 hour for the gravimetric examination and 1 hour to travel to and from the site where the examination is given).

MSHA assumes that all certified persons from underground coal mines will take both the CPDM and gravimetric certification examinations. For underground coal mines, this assumption is likely to result in a slight overestimate of the examination costs for re-certification because a small number of persons may be certified on only one device and take only one examination. For example, after the final requirements to sample the DOs and ODOs with the CPDM go into effect, underground coal mines will need fewer persons certified in the gravimetric sampler. As a result, not every certified person working underground will need to pass the examination for the gravimetric sampler. This slight overestimation for underground coal mines will be offset by

additional hours needed for travel if different persons have to take each exam. Concerning surface coal mines, all certified persons from these mines will take the gravimetric exam.

MSHA estimates that annual costs for certified persons to take the examination to maintain certification to maintain and calibrate sampling equipment are \$38,300 for underground coal mine operators and \$39,750 for surface coal mine operators. Costs for each mine size are shown below:

Underground Coal Mine Operators:

- \$4,042 in mines with 1-19 employees [27 persons taking examinations x ((3 hrs. for examinations and travel x \$33.23 hourly wage rate) + \$50 travel expenses)];
- \$33,081 in mines with 20-500 employees [221 persons taking examinations x ((3 hrs. for examinations and travel x \$33.23 hourly wage rate) + \$50 travel expenses)]; and
- \$1,198 in mines with 501+ employees [8 persons taking examinations x ((3 hrs. for examinations and travel x \$33.23 hourly wage rate) + \$50 travel expenses)].

Surface Coal Mine Operators:

- \$21,996 in mines with 1-19 employees [207 persons taking examinations x ((2 hrs. for examination and travel x \$28.13 hourly wage rate) + \$50 travel expenses)];
- \$17,639 in mines with 20-500 employees [166 persons taking examinations x ((2 hrs. for examination and travel x \$28.13 hourly wage rate) + \$50 travel expenses)]; and
- \$106 in mines with 501+ employees [1 person taking examinations x ((2 hrs. for examination and travel x \$28.13 hourly wage rate) + \$50 travel expenses)].

Cost Estimates for Persons to Retake the Examination to Maintain Certification to Perform Maintenance and Calibration on Sampling Equipment

Some persons taking the examination to maintain their certification to maintain and calibrate sampling equipment will fail the examination and take the examination again. MSHA assumes that 10 percent of certified persons who work at underground coal mines and 5 percent of certified persons who work at surface coal mines will retake the examination. The time required to retake the examination is the same as determined above. However, MSHA does not expect that a person from an underground coal mine taking the examination for the CPDM and the examination concerning the gravimetric sampler will fail both examinations, but instead would only fail one of the examinations.

MSHA estimates that the annual cost for persons who failed the examination and retake it are \$3,000 for underground coal mine operators and \$2,000 for surface coal mine operators. Costs for each mine size are shown below:

Underground Coal Mine Operators:

- \$349 in mines with 1-19 employees [3 persons retaking examination x ((2 hrs. for examination and travel x \$33.23 hourly wage rate) + \$50 travel expenses)];
- \$2,562 in mines with 20-500 employees [22 persons retaking examination x ((2 hrs. for examination and travel x \$33.23 hourly wage rate) + \$50 travel expenses)]; and
- \$116 in mines with 501+ employees [1 person retaking examination x ((2 hrs. for examination and travel x \$33.23 hourly wage rate) + \$50 travel expenses)].

Surface Coal Mine Operators:

- \$1,063 in mines with 1-19 employees [10 persons retaking examination x ((2 hrs. for examination and travel x \$28.13 hourly wage rate) + \$50 travel expense)];
- \$850 in mines with 20-500 employees [8 persons retaking examination x ((2 hrs. for examination and travel x \$28.13 hourly wage rate) + \$50 travel expense)]; and
- \$106 in mines with 501+ employees [1 person retaking examination x ((2 hrs. for examination and travel x \$28.13 hourly wage rate) + \$50 travel expense)].

Table IV-22 shows, by mine size, for underground and surface coal mines, estimated first year costs to certify persons to perform sampling and maintain and calibrate sampling equipment. The dollar amounts in Table IV-22 were derived by summing the first year cost estimates (costs that occur in the first year and do not repeat every year plus annual costs) for final § 70.202 and § 70.203. MSHA estimates that the first year costs to certify persons to sample and to maintain and calibrate sampling equipment are \$1.9 million for underground coal mine operators and \$0.69 million for surface coal mine operators.

**Table IV-22: First Year Costs to Certify Persons
to Sample and Perform Maintenance & Calibration (M&C)
on Sampling Equipment**

Requirements	Std.	1-19	20-500	501+	Total
Underground Coal Operators					
Persons Getting Certified to Sample & Perform M&C	§§70.202(b), 90.202(b) 70.203(b) & 90.203(b)	\$113,100	\$1,335,200	\$141,000	\$1,589,300
Persons Getting Certified to Sample & Perform M&C (Due to Turnover)	§§70.202(b), 90.202(b) 70.203(b) & 90.203(b)	\$9,500	\$106,000	\$10,500	\$126,100
Persons Taking Exams to Maintain Certification to Sample & Perform M&C	§§70.202(c) & 90.202(c)	\$14,800	\$173,300	\$18,100	\$206,300
Persons Retaking Exam Because They Failed the Re-Certification Exam	§§70.202(c) & 90.202(c)	\$1,300	\$14,800	\$1,600	\$17,700
Underground Total		\$138,700	\$1,629,400	\$171,300	\$1,939,300
Surface Coal Operators					
Persons Getting Certified to Sample & Perform M&C	§§71.202(b) & 71.203(b)	\$255,800	\$279,800	\$3,900	\$539,500
Persons Getting Certified to Sample & Perform M&C (Due to Turnover)	§§71.202(b) & 71.203(b)	\$7,700	\$8,400	\$400	\$16,500
Persons Taking Exams to Maintain Certification to Sample & Perform M&C	§§71.202(c) & 71.203(c)	\$60,100	\$63,600	\$800	\$124,600
Persons Retaking Exam Because They Failed the Re-Certification Exam	§§71.202(c) & 71.203(c)	\$3,000	\$3,200	\$200	\$6,400
Surface Total		\$326,600	\$355,100	\$5,300	\$687,000
Total		\$465,300	\$1,984,400	\$176,600	\$2,626,300

^a First Year Costs = cost that occur in the first year which do not repeat every year plus the annual costs.

Table IV-23 shows, by mine size, for underground and surface coal mines, a summary of the annualized cost estimates (annualizing the costs that occur in the first year which do not repeat every year plus the annual costs) to certify persons to perform sampling and maintain and calibrate sampling equipment. The dollar amounts in Table IV-23 were derived by summing the annualized cost estimates for final § 70.202 and § 70.203. MSHA estimates that the annualized costs to certify persons to sample and maintain and calibrate sampling equipment are \$575,700 for underground coal mine operators and \$224, 000 for surface coal mine operators.

**Table IV-23: Annualized Costs to Certify Persons
to Sample and Perform Maintenance & Calibration (M&C)
on Sampling Equipment ^a**

Requirements	Std.	1-19	20-500	501+	Total
Underground Coal Operators					
Persons Getting Certified to Sample & Perform M&C	§§70.202(b), 90.202(b) 70.203(b) & 90.203(b)	\$16,100	\$189,600	\$20,000	\$225,700
Persons Getting Certified to Sample & Perform M&C (Due to Turnover)	§§70.202(b), 90.202(b) 70.203(b) & 90.203(b)	\$9,500	\$106,000	\$10,500	\$126,100
Persons Taking Exams to Maintain Certification to Sample & Perform M&C	§§70.202(c) & 90.202(c)	\$14,800	\$173,300	\$18,100	\$206,300
Persons Retaking Exam Because They Failed the Re-Certification Exam	§§70.202(c) & 90.202(c)	\$1,300	\$14,800	\$1,600	\$17,700
Underground Total		\$41,600	\$483,800	\$50,300	\$575,700
Surface Coal Operators					
Persons Getting Certified to Sample & Perform M&C	§§71.202(b) & 71.203(b)	\$36,300	\$39,700	\$600	\$76,600
Persons Getting Certified to Sample & Perform M&C (Due to Turnover)	§§71.202(b) & 71.203(b)	\$7,700	\$8,400	\$400	\$16,500
Persons Taking Exams to Maintain Certification to Sample & Perform M&C	§§71.202(c) & 71.203(c)	\$60,100	\$63,600	\$800	\$124,600
Persons Retaking Exam Because They Failed the Re-Certification Exam	§§71.202(c) & 71.203(c)	\$3,000	\$3,200	\$200	\$6,400
Surface Total		\$107,100	\$115,000	\$2,000	\$224,000
Total		\$148,800	\$598,700	\$52,300	\$799,800

^a Annualized Costs = annualizing over ten years the costs that occur in the first year which do not repeat every year plus ongoing costs. Also, some of the totals in the table may not round due to rounding.

Record of Production

Final § 70.201(g) requires underground coal mine operators to record the amount of run-of-mine material produced by each MMU during each shift. This information will be used to determine the production achieved during a normal production shift. Production for a normal production shift will be calculated by averaging: production for the most recent 30 production shifts; or for all production shifts if fewer than 30 shifts of production data are available. The operator must retain production records for at least six months and make them available for inspection by authorized representatives of the Secretary and the miners' representative.

Although some mines record the material produced per shift; most do not. MSHA estimates that the 81 MMUs in underground coal mines with 1-19 employees operate 1 shift per

day (or 81 shifts per day). MSHA estimates that material produced is not recorded for 90 percent of these shifts, or 73 shifts per day (81 shifts x 90 percent). MSHA estimates that 708 MMUs in underground coal mines with 20-500 employees operate, on average, 2 shifts per day (or 1,416 shifts per day). MSHA estimates that material produced is not recorded for 75 percent of these shifts or 1,062 shifts per day (1,416 shifts x 75 percent). All mines with 501+ employees are assumed to record the amount of material produced. MSHA estimates that the annual number of workdays is: 200 days in mines with 1-19 employees; and 300 days in mines with 20-500 employees. MSHA assumes that a supervisor, earning \$84.69 an hour, takes 5 minutes (0.0833 hours) to record the material produced on each shift. MSHA estimates that underground coal mine operators' annual costs to record the material produced on each shift are \$2.35 million. Costs for each mine size are shown below:

Underground Coal Mine Operators:

- \$102,998 in mines with 1-19 employees (73 shifts per day x 200 days x 0.0833 hrs. x \$84.69 hourly wage rate); and
- \$2,247,620 in mines with 20-500 employees (1,062 shifts per day x 300 days x 0.0833 hrs. x \$84.69 hourly wage rate).

Record of Shift Length

Final §§ 70.201(e), 71.201(d) and 90.201(f) require the operator to make a record showing the length of each production shift for each MMU, DWP and part 90 miner. The records must be retained for at least six months. The MMU, DWP and part 90 records must be available for inspection by authorized representatives of the Secretary. In addition, the MMU and DWP records must be available for inspection by the miners' representative.

For underground coal mine operators, final §§ 70.211(c) and 90.209(c) require that operators print, sign and post for each MMU, or provide to each part 90 miner the shift length and other information regarding sampling when using a CPDM. Under final §§ 70.210(c) and 90.208(c) the operator must complete a dust card if using a CMDPSU. MSHA assumes that records of shift length required by final §§ 70.201(e) and 90.201(f) are made at the same time that the Dust Data Card is completed under final §§ 70.211(c) and 90.209(c). The time and cost for underground coal mine operators to record shift length required by final §§ 70.201(e) and 90.201(f) is accounted for in this analysis under final §§ 70.211(c) and 90.209(c). There is sufficient time to account for recording shift length under final §§ 70.210(c) and 90.208(c).

The requirement under final § 71.201(d) to record shift length for DWPs involves a new cost for underground coal mine operators who have surface operations. Surface coal mine operators, too, will incur a new cost for recording shift length for their DWPs.

For underground coal mines that have surface operations, MSHA estimates that it takes a miner, earning \$36.92 an hour, 1 minute (0.0167 hours) to record shift length for a DWP. MSHA estimates that the number of DWPs is: 13 DWPs in mines with 1-19 employees; 47 DWPs in mines with 20-500 employees; and 29 DWPs in mines with 501+ employees. MSHA estimates that the average number of shifts per day is 1 in mines with 1-19 employees, and 2 in mines with 20 or more employees. Also, MSHA estimates that the average number of

workdays per year is: 200 in mines with 1-19 employees; 300 in mines with 20-500 employees; and 350 in mines with 501+ employees.

For surface coal mines, MSHA estimates that it takes a miner, earning \$31.26 an hour, 1 minute (0.0167 hours) to record shift length for a DWP. MSHA estimates that the number of DWPs is: 1,107 DWPs in mines with 1-19 employees; 1,759 DWPs in mines with 20-500 employees; and 64 DWPs in mines with 501+ employees. MSHA estimates that the average number of shifts per day is: 1 in mines with 1-19 employees and 2 in mines with 20 or more employees. Also, MSHA estimates that the average number of workdays per year is: 250 in mines with 1-19 employees; 300 in mines with 20-500 employees; and 350 in mines with 501+ employees.

MSHA estimates that the annual costs for making a record of the shift length are \$31,500 for surface operations at underground coal and \$718,800 for surface coal mines. Costs for underground and surface coal mine operators for each mine size are shown below:

Underground Coal Mine Operators:

- \$1,603 in mines with 1-19 employees (13 DWPs x 1 shift per day x 200 workdays x \$36.92 hourly wage rate x 0.0167 hrs.);
- \$17,387 in mines with 20-500 employees (47 DWPs x 2 shifts per day x 300 workdays x \$36.92 hourly wage rate x 0.0167 hrs.); and,
- \$12,516 in mines with 501+ employees (29 DWPs x 2 shifts per day x 350 workdays x \$36.92 hourly wage rate x 0.0167 hrs.).

Surface Coal Mine Operators:

- \$144,475 in mines with 1-19 employees (1,107 DWPs x 1 shift per day x 250 workdays x \$31.26 hourly wage rate x 0.0167 hrs.);
- \$550,963 in mines with 20-500 employees (1,759 DWPs x 2 shifts per day x 300 workdays x \$31.26 hourly wage rate x 0.0167 hrs.); and,
- \$23,387 in mines with 501+ employees (64 DWPs x 2 shifts per day x 350 workdays x \$31.26 hourly wage rate x 0.0167 hrs.).

Table IV-24 shows that underground coal mine operators will incur annual costs of approximately \$2.4 million that are associated with recording production and shift length, and surface coal mine operators will incur costs of approximately \$718,800 that are associated with recording shift length.

Table IV-24: Annual Cost Estimates for Recording Production and Shift Length

Requirements	1-19	20-500	501+	Total
Underground Coal Operators				
Record Shift Length	\$1,600	\$17,400	\$12,500	\$31,500
Record Material Produced	\$103,000	\$2,247,600	\$0	\$2,350,600
Total	\$104,600	\$2,265,000	\$12,500	\$2,382,100
Surface Coal Operators				
Record Shift Length	\$144,500	\$551,000	\$23,400	\$718,800

Cost Estimates for Using Gravimetric Samplers

Final §§ 70.206, 70.207, 70.208, 70.209, 71.206 and 90.207 revise the existing bimonthly sampling requirements and thus change the amount of sampling conducted with the gravimetric sampler. Currently, operators conduct the required sampling in one of three ways: some sample using their own equipment, some sample using rented equipment, and some hire contractors to sample. The amount of sampling required under the final rule is greater than is currently required (e.g., final § 70.209 requires underground coal mine operators to sample designated areas (DAs) on 5 consecutive production shifts whereas currently only 1 sample is taken for each DA; and final § 71.206 expands the number of DWPs that will be sampled at surface coal mines). MSHA has determined that the Agency's historical experience does not provide a good indication of how operators will choose to sample to meet the final rule requirements. Instead, MSHA assumes that due to the increased sampling requirements all mine operators will choose to purchase the sampling units and conduct sampling. If some operators choose to use an alternative means that proves to be less expensive, then the cost estimates presented below are overstated.

Cost Estimates to Purchase Gravimetric Sampling Devices

MSHA assumes that underground coal mine operators currently have sufficient numbers of gravimetric samplers to conduct the sampling required by the final rule. Underground and surface coal mine operators' cost estimates related to sampling with the gravimetric sampler are presented below.

Surface coal mine operators currently sample approximately 320 DWPs at approximately 225 mines. This represents approximately 20 percent of all surface coal mines. Final § 71.206(c) expands the number of DWPs and requires that all surface coal mines perform sampling. Under the final rule, surface coal mine operators have the option to use either a gravimetric sampler or a CPDM to conduct DWP sampling. When the rule is in effect, MSHA assumes that surface coal mine operators will choose to conduct sampling with the less expensive gravimetric sampler unless they have part 90 miners who must be sampled with the CPDM. Therefore, 898 surface coal mine operators that currently do not sample will need to purchase gravimetric samplers (1,123 surface coal mine operators x 80 percent).

MSHA estimates that the number of additional gravimetric samplers needed at surface coal mines will be: 1 at mines with 1-19 employees; 2 at mines with 20-500 employees; and 3 at mines with 501+ employees. MSHA assumes that the 225 surface coal mines currently sampling have 1 gravimetric sampler per mine, and these mines will need 1 additional unit in mines with 20-500 employees and 2 additional units in mines with 501+ employees. Therefore, MSHA estimates that surface coal mine operators need to purchase 1,405 additional gravimetric samplers as follows:

- 496 samplers in mines with 1-19 employees (620 surface mines x 1 sampler x 80 percent);
- 898 samplers in mines with 20-500 employees (499 surface mines x 2 samplers x 80 percent) + (499 surface mines x 1 sampler x 20 percent); and
- 11 samplers in mines with 501+ employees (4 surface mines x 3 samplers x 80 percent) + (4 surface mines x 2 samplers x 20 percent).

MSHA estimates that a gravimetric sampler costs \$700 and has a useful life of 5 years. Thus, the first year costs for surface coal mine operators to purchase gravimetric samplers are approximately \$983,500. Costs for each mine size are shown below:

Surface Coal Mine Operators:

- \$347,200 in mines with 1-19 employees (496 samplers x \$700 per sampler);
- \$628,600 in mines with 20-500 employees (898 samplers x \$700 per sampler); and
- \$7,700 in mines with 501+ employees (11 samplers x \$700 per sampler).

First year cost estimates were multiplied by an annualization factor of 0.244 based on a 7 percent discount rate to reflect the 5-year service life. Annualized costs for surface coal mine operators are approximately \$239,975.

Cost Estimates for Listing the Designated Work Positions (DWP)

Final § 71.206(d) requires operators to provide the MSHA District Manager with a list identifying the specific work positions where DWP samples will be collected. Also, under final § 71.201(a) the operator will conduct DWP sampling with an approved CMDPSU (a gravimetric sampler) unless the operator notifies the District Manager in writing that an approved CPDM will be used for all DWP sampling. MSHA does not expect that operators will choose to conduct DWP sampling with a CPDM, however, if they choose to do so, then the notification can be submitted to MSHA along with the list of DWPs. MSHA estimates that 12 minutes (0.2 hours) is sufficient for a supervisor to prepare the list and a notification. A supervisor's hourly wage rate is \$84.69 at underground mines and \$71.18 at surface coal mines. MSHA estimates that a clerical employee takes an additional 12 minutes (0.2 hours) to prepare and send the material to MSHA. A clerical employee hourly wage rate is \$28.67 at underground mines and \$23.91 at surface coal mines. Postage is \$1.

MSHA estimates that the number of underground coal mines with surface areas that have DWPs is: 3 mines with 1-19 employees; 21 mines with 20-500 employees; and 8 mines with 501+ employees. MSHA estimates that the number of surface coal mines with DWPs is: 620 mines with 1-19 employees; 499 mines with 20-500 employees; and 4 mines with 501+ employees.

MSHA estimates that first year costs are \$750 for underground coal mine operators and \$22,500 for surface coal mine operators. Costs for each mine size are shown below:

Underground Coal Mine Operators:

- \$71 in mines with 1-19 employees [3 mines x ((0.2 hrs. x \$84.69 hourly wage rate) + (0.2 hrs. x \$28.67 hourly wage rate) + \$1 postage)];
- \$497 in mines with 20-500 employees [21 mines x ((0.2 hrs. x \$84.69 hourly wage rate) + (0.2 hrs. x \$28.67 hourly wage rate) + \$1 postage)]; and
- \$189 in mines with 501+ employees [8 mines x ((0.2 hrs. x \$84.69 hourly wage rate) + (0.2 hrs. x \$28.67 hourly wage rate) + \$1 postage)].

Surface Coal Mine Operators:

- \$12,411 in mines with 1-19 employees [620 mines x ((0.2 hrs. x \$71.18 hourly wage rate) + (0.2 hrs. x \$23.91 hourly wage rate) + \$1 postage)];
- \$9,989 in mines with 20-500 employees [499 mines x ((0.2 hrs. x \$71.18 hourly wage rate) + (0.2 hrs. x \$23.91 hourly wage rate) + \$1 postage)]; and
- \$80 in mines with 501+ employees [4 mines x ((0.2 hrs. x \$71.18 hourly wage rate) + (0.2 hrs. x \$23.91 hourly wage rate) + \$1 postage)].

First year cost estimates were annualized over 10 years by multiplying them by a factor of 0.142 based on a 7 percent discount rate to arrive at an annualized cost estimate of \$100 for underground coal mine operators and \$3,200 for surface coal mine operators.

MSHA assumes that 10 percent of mines each year (including the first year) will update their lists. MSHA estimates that the annual costs to update the list of DWPs are \$100 for underground coal mine operators and \$2,275 for surface coal mine operators. Costs for each mine size are shown below.

Underground Coal Mine Operators:

- \$24 in mines with 1-19 employees [1 mine x ((0.2 hrs. x \$84.69 hourly wage rate) + (0.2 hrs. x \$28.67 hourly wage rate) + \$1 postage)];
- \$47 in mines with 20-500 employees [2 mines x ((0.2 hrs. x \$84.69 hourly wage rate) + (0.2 hrs. x \$28.67 hourly wage rate) + \$1 postage)]; and
- \$24 in mines with 501+ employees [1 mine x ((0.2 hrs. x \$84.69 hourly wage rate) + (0.2 hrs. x \$28.67 hourly wage rate) + \$1 postage)].

Surface Coal Mine Operators:

- \$1,241 in mines with 1-19 employees [62 mines x ((0.2 hrs. x \$71.18 hourly wage rate) + (0.2 hrs. x \$23.91 hourly wage rate) + \$1 postage)];
- \$1,001 in mines with 20-500 employees [50 mines x ((0.25 hrs. x \$71.18 hourly wage rate) + (0.2 hrs. x \$23.91 hourly wage rate) + \$1 postage)]; and
- \$20 in mines with 501+ employees [1 mine x ((0.2 hrs. x \$71.18 hourly wage rate) + (0.2 hrs. x \$23.91 hourly wage rate) + \$1 postage)].

Changes in Gravimetric Sampling as a Result of the Final Rule

Underground Coal Mine Operators

No. of Gravimetric Samples in Underground Coal Mines During First Year of Final Rule

During the first year that the final rule is in effect, MSHA estimates that there will be 17,072 additional samples taken with the gravimetric sampler, of which: 1,510 samples will be in mines with 1-19 employees; 13,554 samples will be in mines with 20-500 employees; and 2,008 samples will be in mines with 501+ employees. Below is an explanation of how these additional samples were derived.

- Final § 70.206 makes no changes to DO sampling, which currently requires 5 DO samples to be taken bi-monthly. However, due to the definition of normal production shift under the final rule, MSHA estimates that it will take 8 samples to get 5 valid DO samples (an addition of 3 samples).¹² Thus, in the first year this results in an additional 15,858 DO samples, of which 1,458 samples are in mines with 1-19 employees (81 MMUs x 3 additional DO samples x 6 bi-monthly periods); 12,744 samples are in mines with 20-500 employees (708 MMUs x 3 additional DO samples x 6 bi-monthly periods); and 1,656 samples in mines with 501+ employees (92 MMUs x 3 additional DO samples x 6 bi-monthly periods).
- Final § 70.207 makes no changes in DA sampling in the first year.
- Final § 90.207(a) reduces the sampling frequency for part 90 miners from existing 6 times per year to 4 times per year, and increases the number of samples taken each time a part 90 miner is sampled from 1 to 5. Thus, in the first year each part 90 miner has an increase of 14 additional samples with the gravimetric sampler [(5 samples x 4 times per yr.) – (1 sample x 6 times per yr.)]. In the first year this results in 924 additional part 90 samples, of which: no samples are at mines with 1-19 employees (no part 90 miners at these mines); 658 samples at mines with 20-500 employees (47 part 90 miners x 14 samples); and 266 samples at mines with 501+ employees (19 part 90 miners x 14 samples).
- Currently, each DWP is sampled 6 times per year. Final § 71.206(a) requires that each DWP be sampled 4 times per year. Also, under the final rule, the Agency expects an increase in the number of DWPs. Therefore, MSHA estimates that under the final rule the number of additional DWP samples at surface areas of underground coal mines in the first year increases to 290, of which: 52 samples are at mines with 1-19 employees (13 projected DWPs x 4 samples per yr.); 152 samples are at mines with 20-500 employees [(47 projected & existing DWPs x 4 samples per yr.) – (6 existing DWPs x 6 samples per yr.)]; and 86 samples at mines with 501+ employees [(29 projected & existing DWPs x 4 samples per yr.) – (5 existing DWPs x 6 samples per yr.)].

¹² U.S. Department of Labor, MSHA, 2012, Addendum to Number of Shifts Required to Meet Specified Production Criteria, Statistical Methods and Analysis, March 1, 2012; and U.S. Department of Labor, MSHA, 2012, Addendum to Number of Shifts Required To Meet Specified Production Criteria, Statistical Methods and Analysis, March 16, 2012.

No. of Gravimetric Samples in Underground Coal Mines in Second Year of Final Rule

Eighteen months after the effective date of the final rule (or half way into the second year), operators will sample DOs, ODOs and part 90 miners with the CPDM rather than the gravimetric sampler. In addition, the number of outby and intake DA samples will increase. MSHA estimates that there will be a net reduction of 2,210 samples that will no longer be taken with the gravimetric sampler, of which: 109 fewer samples will be in mines with 1-19 employees; 2,090 fewer samples will be in mines with 20-500 employees; and 11 fewer samples will be in mines with 501+ employees. Below is an explanation of how these sample numbers were derived.

- Currently, each DO is sampled 30 times per year with a gravimetric sampler (1 DO x 5 samples x 6 bimonthly periods per yr.). As noted above, due to the definition of normal production shift under the final rule, MSHA estimates that 3 additional DO samples will need to be taken to obtain 5 valid DO samples. Also, 18 months after the effective date of the final rule (or half way into the second year of the rule), DO samples will be taken with a CPDM. Therefore, in the second year of the rule, there will be 15 samples for each DO that will no longer be taken with a gravimetric sampler (1 DO x 5 samples x 3 bi-monthly periods). Thus, the total net reduction in the number of DO samples taken with a gravimetric sampler in the second year of the rule will be 5,286, of which: 486 fewer samples are at mines with 1-19 employees [(81 MMUs x 3 additional DO samples x 3 bi-monthly periods) minus (81 MMUs x 5 DO samples x 3 bi-monthly periods)]; 4,248 fewer samples are at mines with 20-500 employees [(708 MMUs x 3 additional DO samples x 3 bi-monthly periods) minus (708 MMUs x 5 DO samples x 3 bi-monthly periods)]; and 552 fewer samples are at mines with 501+ employees [(92 MMUs x 3 additional DO samples x 3 bi-monthly periods) minus (92 MMUs x 5 DO samples x 3 bi-monthly periods)].
- Currently, each Roof Bolter DA (RB-DA) is sampled 6 times per year with the gravimetric sampler (1 RB-DA sample x 6 bimonthly periods). However, 18 months after the effective date of the final rule (or half way into the second year of the rule) RB-DAs will be re-designated as ODOs and these samples will be taken with a CPDM. Therefore, in the second year of the rule, 3 RB-DA samples will no longer be taken with a gravimetric sampler (1 RB-DA sample x 3 bi-monthly periods). The total number of RB-DA samples no longer taken with a gravimetric sampler in the second year of the rule will be 1,356, of which: 123 fewer samples are at mines with 1-19 employees (41 RB-DAs x 3 samples); 1,164 fewer samples are at mines with 20-500 employees (388 RB-DAs x 3 samples); and 69 fewer samples are at mines with 501+ employees (23 RB-DAs x 3 samples).
- Currently, each part 90 miner is sampled 6 times per year with the gravimetric sampler (1 part 90 miner sample x 6 bi-monthly periods). In the first half of the second year 5 samples will be taken with a gravimetric sampler for each part 90 miner per quarter. Thus, in the first half of the second year there is an increase of 7 samples taken with a gravimetric sampler [(5 samples taken in the first half of the second year x 2 quarters) – (1 sample taken in the first half of the second year x 3 bi-monthly periods)]. In addition, 18 months after the effective date of the final rule (or in the second half of the second year) part 90 miner sampling with the gravimetric sampler will be replaced with the CPDM. Thus, in the second half of the second year, 3 samples will no longer

be taken with the gravimetric sampler [(1 sample x 3 bi-monthly periods)]. The net effect in the second year is that for each part 90 miner there will be 4 additional samples taken with the gravimetric sampler. The total number of additional part 90 samples taken with the gravimetric sampler in the second year will be 264 samples, of which: no samples are at mines with 1-19 employees (no part 90 miners at these mines); 188 samples are at mines with 20-500 employees (47 part 90 miners x 4 samples); and 76 samples are at mines with 501+ employees (19 part 90 miners x 4 samples).

- Currently, each outby and intake DA (other DAs) is sampled 6 times per year with the gravimetric sampler (1 DA sample x 6 bimonthly periods). However, 18 months after the effective date of the final rule (or half way into the second year of the rule) each of these other DAs will be sampled 5 times per quarter with the gravimetric sampler. Therefore, in the second year of the rule, there will be a net increase of 7 samples for each of these DAs that are taken with a gravimetric sampler [(5 samples taken in second half of year x 2 Quarters) – (1 sample taken in second half of year x 3 bimonthly periods)]. The total number of additional other DA samples taken with the gravimetric sampler in the second year of the rule will be 3,878, of which: 448 samples are at mines with 1-19 employees (64 DAs x 7 samples); 2,982 samples are at mines with 20-500 employees (426 DAs x 7 samples); and 448 samples are at mines with 501+ employees (64 DAs x 7 samples).
- The DWP sampling in the second year of the rule will be the same as in the first year. Thus, the number of additional DWP samples at surface areas of underground coal mines in the second year is 290, of which: 52 samples are at mines with 1-19 employees (13 projected DWPs x 4 samples per yr.); 152 samples are at mines with 20-500 employees [(47 projected & existing DWPs x 4 samples per yr.) – (6 existing DWPs x 6 samples per yr.)]; and 86 samples are at mines with 501+ employees [(29 projected & existing DWPs x 4 samples per yr.) – (5 existing DWPs x 6 samples per yr.)].

No. of Gravimetric Samples in Underground Coal Mines During Third Year of Final Rule and Every Year Thereafter

During the third year that the final rule is in effect, and every year thereafter, MSHA estimates that there will be 21,492 samples no longer taken with the gravimetric sampler, of which: 1,728 samples will be in mines with 1-19 employees; 17,734 samples will be in mines with 20-500 employees; and 2,030 samples will be in mines with 501+ employees. Below is an explanation of how these reduced samples were derived.

- In the third year of the rule, and every year thereafter, all DO sampling will be done with the CPDM instead of the gravimetric sampler. Thus, 30 samples will no longer be taken with the gravimetric sampler for each DO (1 DO x 5 samples x 6 bi-monthly periods). The total number of DO samples no longer taken with the gravimetric sampler in the third year of the rule, and every year thereafter, will be 26,430, of which: 2,430 samples are at mines with 1-19 employees (81 MMUs x 1 DO x 30 samples); 21,240 samples are at mines with 20-500 employees (708 MMUs x 1 DO

x 30 samples); and 2,760 samples are at mines with 501+ employees (92 MMUs x 1 DO x 30 samples).

- In the third year of the rule, and every year thereafter, all Roof Bolter DAs (RB-DAs) are redesignated as ODOs. Thus, 6 samples will no longer be taken with the gravimetric sampler for each RB-DA (1 RB-DA x 1 sample x 6 bi-monthly periods). The total number of RB-DAs samples no longer taken with the gravimetric sampler in the third year of the rule, and every year thereafter, will be 2,712, of which: 246 samples are at mines with 1-19 employees (41 RB-DAs x 6 samples); 2,328 samples are at mines with 20-500 employees (388 RB-DAs x 6 samples); and 138 samples are at mines with 501+ employees (23 RB-DAs x 6 samples).
- In the third year of the rule, and every year thereafter, all part 90 miner sampling will be done with the CPDM instead of the gravimetric sampler. Thus, 6 samples will no longer be taken with the gravimetric sampler for each part 90 miner (1 part 90 miner sample x 6 bi-monthly periods). The total number of part 90 miner samples no longer taken with the gravimetric sampler in the third year of the rule, and every year thereafter, will be 396, of which: no samples are at mines with 1-19 employees; 282 fewer samples are at mines with 20-500 employees (47 part 90 miners x 1 sample x 6 bi-monthly periods); and 114 fewer samples are at mines with 501+ employees (19 part 90 miners x 1 sample x 6 bimonthly periods).
- In the third year of the rule, and every year thereafter, each outby and intake Designated Area (DA) will be sampled 5 times per quarter with the gravimetric sampler, instead of once each bi-monthly period. Thus, 14 additional samples will be taken with the gravimetric sampler in the third year, and every year thereafter, [(5 samples x 4 quarters per year) – (1 sample x 6 bi-monthly periods per year)]. The total number of additional other DA samples taken with the gravimetric sampler in the third year of the rule, and every year thereafter, will be 7,756, of which: 896 samples are at mines with 1-19 employees (64 DAs x 14 samples); 5,964 samples are at mines with 20-500 employees (426 DAs x 14 samples); and 896 samples are at mines with 501+ employees (64 DAs x 14 samples).
- The additional Designated Work Position (DWP) samples in the third year of the rule, and every year thereafter, will be the same as in the first year. Thus, the number of additional DWP samples at surface areas of underground coal mines in the third year, and every year thereafter, is 290, of which: 52 samples are at mines with 1-19 employees (13 projected DWPs x 4 samples per yr.); 152 samples are at mines with 20-500 employees [(47 projected & existing DWPs x 4 samples per yr.) – (6 existing DWPs x 6 samples per yr.)]; and 86 samples are at mines with 501+ employees [(29 projected & existing DWPs x 4 samples per yr.) – (5 existing DWPs x 6 samples per yr.)].

Derivation of Cost Estimates Related to Gravimetric Sampling in Underground Coal Mines

On average, MSHA estimates that it takes 1 hour to prepare the gravimetric sampler and perform the required checks during sampling. This time period includes 50 minutes (0.8333 hours) of a certified dust technician's time to prepare, disassemble, and clean the gravimetric

sampler after completion of sampling. In addition, MSHA estimates that it takes a supervisor 10 minutes (0.1666 hours) to make operational checks of the sampling device during the shift. In an underground coal mine, the hourly wage rates are \$33.23 for a certified dust technician and \$84.69 for a supervisor. The cost for each filter used is \$19.89. Two filters are used for each sample; the filter to take the sample and the control filter. MSHA estimates that the cost to take a sample is \$81.58 ($\$33.23 \text{ per hr.} \times 0.8333 \text{ hrs.} + \$84.69 \text{ per hr.} \times 0.1666 \text{ hrs.} + \$19.89 \text{ per filter} \times 2 \text{ filters}$) in an underground coal mine.

Underground Coal Mine Operators

First Year of Final Rule

Based on the estimates for the number of gravimetric samples, MSHA estimates that during the first year that the final rule is in effect, final §§ 70.201(a), 70.208(a), 70.209(a), 90.201(a) and 90.207(a) result in a net increase in gravimetric sampling costs in underground coal mines of \$1.4 million. Costs for each mine size are shown below:

- \$123,186 in mines with 1-19 employees (1,510 samples x \$81.58 per sample);
- \$1,105,735 in mines with 20-500 employees (13,554 samples x \$81.58 per sample); and
- \$163,813 in mines with 501+ employees (2,008 samples x \$81.58 per sample).

Second Year of Final Rule

Based on the estimates for the number of gravimetric samples, MSHA estimates that during the second year that the final rule is in effect, final §§ 70.201(a), 70.208(b), 70.209(a), 90.201(a) and 90.207(a) result in a net decrease in gravimetric sampling costs in underground coal mines of \$180,300. The cost savings for each mine size are shown below with a negative sign to emphasize that they are cost reductions:

- -\$8,892 in mines with 1-19 employees (109 samples x \$81.58 per sample);
- -\$170,502 in mines with 20-500 employees (2,090 samples x \$81.58 per sample); and
- -\$897 in mines with 501+ employees (11 samples x \$81.58 per sample).

Third Year of Final Rule and Every Year Thereafter

Based on the estimates for the number of gravimetric samples, MSHA estimates that during the third year that the final rule is in effect and every year thereafter, final §§ 70.201(a), 70.208(b), 70.209(a), 90.201(a) and 90.207(a) result in a net decrease in gravimetric sampling costs in underground coal mines of \$1.75 million. The cost savings for each mine size are shown below with a negative sign to emphasize that they are cost reductions:

- -\$140,970 in mines with 1-19 employees (1,728 samples x \$81.58 per sample);
- -\$1,446,740 in mines with 20-500 employees (17,734 samples x \$81.58 per sample); and
- -\$165,607 in mines with 501+ employees (2,030 samples x \$81.58 per sample).

Under the final rule, the net cost savings concerning gravimetric sampling in underground coal mines changes each year until the third year, after which it remains constant. The Agency estimated costs that will be incurred over a 10-year period by multiplying each year's costs (excluding the costs in the first year) by a discount factor. MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent

discount rate to arrive at annual cost saving estimates of: \$95,386 for mines with 1-19 employees; \$1,011,938 for mines with 20-500 employees; and \$108,078 for mines with 501+ employees.

Surface Coal Mine Operators

No. of Gravimetric Samples in Surface Coal Mines During First Year of the Final Rule, and Every Year Thereafter

For the first 18 months that the final rule is in effect, part 90 miners will be sampled with the gravimetric sampler; after 18 months they will be sampled with the CPDM. Due to timing associated with scheduling x-ray examinations for miners, analyzing and obtaining x-ray results, the time needed for operators to set up a part 90 program in accordance with NIOSH requirements, and time for miners to exercise their part 90 miner rights, MSHA assumes that any part 90 miner sampling at surface coal mines will begin in the second half of the second year that the final rule is in effect. Thus, at surface coal mines, part 90 miners are assumed to be sampled with the CPDM.

During the first year that the final rule is in effect, and every year thereafter, MSHA estimates that there will be 9,878 increased DWP samples taken with the gravimetric sampler, of which: 3,564 samples will be in mines with 1-19 employees; 6,076 samples will be in mines with 20-500 employees; and 238 samples will be in mines with 501+ employees. Below is an explanation of how these reduced samples were derived.

- Final § 71.206(a) requires each DWP to be sampled 4 times per year rather than the 6 times per year currently required, and final § 71.206(c) increases the number of DWPs from the current 307 to 2,930. This increases the number of samples taken by 9,878 [(2,930 projected & existing samples x 4 times per yr.) – (307 existing samples x 6 times per yr.)].
- Of the additional 9,878 samples: 3,564 samples are in mines with 1-19 employees (1,107 projected and existing DWPs x 4 samples per year – 144 existing DWPs x 6 samples per year); 6,076 samples are in mines with 20-500 employees (1,759 projected and existing DWP samples x 4 samples per year – 160 existing DWP x 6 samples per year); and 238 samples are in mines with 501+ employees (64 projected and existing DWP x 4 samples per year – 3 existing DWP x 6 samples per year).

Derivation of Cost Estimates Related to Gravimetric Sampling in Surface Coal Mines

On average, MSHA estimates that it takes 1 hour to prepare the gravimetric sampler and perform the required checks during sampling. This time period includes 50 minutes (0.8333 hours) of a certified dust technician's time to prepare, disassemble, and clean the gravimetric sampler after completion of sampling. In addition, MSHA estimates that it takes a supervisor 10 minutes (0.1666 hours) to make operational checks of the sampling device during the shift. In a surface coal mine, the hourly wage rates are \$28.13 for a certified dust technician and \$71.18 for a supervisor. The cost for each filter used is \$19.89. Two filters are used for each sample; the filter to take the sample and the control filter. MSHA estimates that the cost to take a sample is \$75.08 (\$28.13 per hr. x 0.8333 hrs. + \$71.18 per hr. x 0.1666 hrs. + \$19.89 per filter x 2 filters) in an underground coal mine.

First Year of Final Rule and Every Year Thereafter

MSHA estimates that in the first year that the final rule is in effect, and every year thereafter, final § 71.206(a) results in increased gravimetric sampling costs in surface coal mines of \$741,600. Costs for each mine size are shown below:

- \$267,585 in mines with 1-19 employees (3,564 samples x \$75.08 per sample);
- \$456,186 in mines with 20-500 employees (6,076 samples x \$75.08 per sample); and
- \$17,869 in mines with 501+ employees (238 samples x \$75.08 per sample).

Cost Estimates for Transmitting the Gravimetric Samples to MSHA

Final §§ 70.210, 71.207 and 90.208 require each sample, along with the control filter and a completed Dust Data Card, to be transmitted to MSHA. The Dust Data Card is provided by the manufacturer with each filter cassette. On each Dust Data Card, the person collecting the sample writes information on conditions when the sample was collected. Normally these tasks are performed by a certified dust technician earning \$33.23 per hour in an underground coal mine and \$28.13 per hour in a surface coal mine. On average, MSHA estimates that a certified dust technician takes 6 minutes (0.1 hours) to prepare and send one sample, along with control filter and the Dust Data Card, to MSHA.

After the Dust Data Card has been filled out, a certified person signs the card and writes their MSHA Individual Identification Number (MIIN) on it. On average, MSHA estimates that a certified person (normally the mine safety inspector or an equivalent person, such as a supervisor) takes 1.5 minutes (0.025 hours) to complete and sign the Dust Data Card. MSHA estimates that a supervisor's hourly wage rate is \$84.69 in an underground coal mine and \$71.18 in a surface coal mine.

For underground coal mine operators, MSHA estimates that the first year the final rule is in effect, there will be a net increase in the number of samples that operators must submit to MSHA, while in the following years, there will be a net decrease in the number of samples that operators must submit to MSHA. For surface coal mine operators, MSHA estimates that the first year the final rule is in effect, and every year thereafter, there will be an increase in the number of samples that operators must submit to MSHA. These changes in the number of samples were determined earlier in this section that concerns changes in gravimetric sampling as a result of the final rule.

Since paragraph (a) of final §§ 70.210, 71.207 and 90.208 also requires that the operator transmit within 24 hours after the end of the sampled shift all samples collected, including control filters, MSHA makes the following assumptions. Mines with 1-19 employees will submit one sample per mailing since these mines mainly operate one shift per day. Mines with 20-500 employees and mines with 501+ employees will submit two samples per mailing since these mines on average operate two shifts per day. The cost per mailing is estimated to be \$1.

Underground Coal Mine Operators

First Year of the Final Rule

MSHA estimates that costs of transmitting gravimetric samples for the first year that the final rule is in effect are \$102,200. Costs for each mine size are shown below:

- \$9,725 in mines with 1-19 employees [1,510 samples x ((0.1 hrs. x \$33.23 hourly wage rate) + (0.025 hrs. x \$84.69 hourly wage rate))] + [1,510 samples x \$1 postage];
- \$80,514 in mines with 20-500 employees [13,554 samples x ((0.1 hrs. x \$33.23 hourly wage rate) + (0.025 hrs. x \$84.69 hourly wage rate))] + [(13,554 samples / 2) x \$1 postage]; and
- \$11,928 in mines with 501+ employees [2,008 samples x ((0.1 hrs. x \$33.23 hourly wage rate) + (0.025 hrs. x \$84.69 hourly wage rate))] + [(2,008 samples / 2) x \$1 postage].

Second Year of the Final Rule

MSHA estimates that the cost savings of transmitting gravimetric samples for the second year that the final rule is in effect are \$13,200. Cost savings for each mine size are shown below with a negative sign to emphasize that they are cost reductions:

- -\$702 in mines with 1-19 employees: [109 samples x ((0.1 hrs. x \$33.23 hourly wage rate) + (0.025 hrs. x \$84.69 hourly wage rate))] + [109 samples x \$1 postage];
- -\$12,415 in mines with 20-500 employees: [2,090 samples x ((0.1 hrs. x \$33.23 hourly wage rate) + (0.025 hrs. x \$84.69 hourly wage rate))] + [(2,090 samples / 2) x \$1 postage]; and
- -\$65 in mines with 501+ employees: [11 samples x ((0.1 hrs. x \$33.23 hourly wage rate) + (0.025 hrs. x \$84.69 hourly wage rate))] + [(11 samples / 2) x \$1 postage].

Third Year of the Final Rule and Every Year Thereafter

MSHA estimates that cost savings of transmitting gravimetric samples for the third year that the final rule is in effect, and every year thereafter, are \$128,550. Cost savings for each mine size are shown below with a negative sign to emphasize that they are cost reductions:

- -\$11,129 in mines with 1-19 employees [1,728 samples x ((0.1 hrs. x \$33.23 hourly wage rate) + (0.025 hrs. x \$84.69 hourly wage rate))] + [1,728 samples x \$1 postage];
- -\$105,344 in mines with 20-500 employees [17,734 samples x ((0.1 hrs. x \$33.23 hourly wage rate) + (0.025 hrs. x \$84.69 hourly wage rate))] + [(17,734 samples / 2) x \$1 postage]; and
- -\$12,059 in mines with 501+ employees [2,030 samples x ((0.1 hrs. x \$33.23 hourly wage rate) + (0.025 hrs. x \$84.69 hourly wage rate))] + [(2,030 samples / 2) x \$1 postage].

Under the final rule, the net cost saving of transmitting gravimetric samples in underground coal mines changes each year until the third year, after which it remains constant. The Agency estimated costs that will be incurred over a 10-year period by multiplying each year's costs (excluding the costs in the first year) by a discount factor. MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at annual cost saving estimates of: \$7,530 for mines with 1-19 employees; \$73,684 for mines with 20-500 employees; and \$7,870 for mines with 501+ employees.

Surface Coal Mine Operators

First Year of the Final Rule and Every Year Thereafter

MSHA estimates that costs of transmitting gravimetric samples for the first year that the final rule is in effect, and every year thereafter, are \$52,100. Costs for each mine size are shown below:

- \$19,932 in mines with 1-19 employees [3,564 samples x ((0.1 hrs. x \$28.13 hourly wage rate) + (0.025 hrs. x \$71.18 hourly wage rate))] + [3,564 samples x \$1 postage];
- \$30,942 in mines with 20-500 employees [6,076 samples x ((0.1 hrs. x \$28.13 hourly wage rate) + (0.025 hrs. x \$71.18 hourly wage rate))] + [(6,076 samples / 2) x \$1 postage]; and
- \$1,212 in mines with 501+ employees [238 samples x ((0.1 hrs. x \$28.13 hourly wage rate) + (0.025 hrs. x \$71.18 hourly wage rate))] + [(238 samples / 2) x \$1 postage].

Post Sampling Data; Provide Sampling Data to the Part 90 Miner

Operators are required to post sampling data on the mine bulletin board under final §§ 70.211(b) at underground coal mines, and 71.208(b) at surface coal mines. Under final § 90.209(b), underground and surface coal mine operators must only provide part 90 miners with a copy of the sampling data. For purposes of this cost analysis, MSHA assumes that it takes the same amount of time to provide a copy of the gravimetric sampling data to the part 90 miner as it does to post it on the mine bulletin board. On average, MSHA estimates that a clerical employee takes 6 minutes (0.1 hours) to copy and post the sampling data. MSHA estimates copying costs are \$0.15 per page. The hourly wage rate for a clerical employee is \$28.67 in an underground coal mine and \$23.91 in a surface coal mine.

Underground Coal Mine Operators

First Year of the Final Rule

MSHA estimates that for the first year that the final rule is in effect costs for posting gravimetric sampling data are \$51,500. Costs for each mine size are shown below:

- \$4,556 in mines with 1-19 employees [1,510 postings x ((0.1 hrs. x \$28.67 hourly wage rate) + (1 pg. x \$0.15))];
- \$40,892 in mines with 20-500 employees [13,554 postings x ((0.1 hrs. x \$28.67 hourly wage rate) + (1 pg. x \$0.15))]; and
- \$6,058 in mines with 501+ employees [2,008 postings x ((0.1 hrs. x \$28.67 hourly wage rate) + (1 pg. x \$0.15))].

Second Year of the Final Rule

MSHA estimates that for the second year that the final rule is in effect cost savings for posting gravimetric sampling data are \$6,675. The cost savings for each mine size are shown below, with a negative sign to emphasize that they are cost reductions:

- -\$329 in mines with 1-19 employees [109 reduced postings x ((0.1 hrs. x \$28.67 hourly wage rate) + (1 pg. x \$0.15))];
- -\$6,306 in mines with 20-500 employees [2,090 reduced postings x ((0.1 hrs. x \$28.67 hourly wage rate) + (1 pg. x \$0.15))]; and

- -\$33 in mines with 501+ employees [11 reduced postings x ((0.1 hrs. x \$28.67 hourly wage rate) + (1 pg. x \$0.15))].

Third Year of the Final Rule and Every Year Thereafter

MSHA estimates that for the third year that the final rule is in effect, and every year thereafter, cost savings for posting gravimetric sampling data are \$64,800. The cost savings for each mine size are shown below with a negative sign to emphasize that they are cost reductions:

- -\$5,213 in mines with 1-19 employees [1,728 reduced postings x ((0.1 hrs. x \$28.67 hourly wage rate) + (1 pg. x \$0.15))];
- -\$53,503 in mines with 20-500 employees [17,734 reduced postings x ((0.1 hrs. x \$28.67 hourly wage rate) + (1 pg. x \$0.15))]; and
- -\$6,125 in mines with 501+ employees [2,030 reduced postings x ((0.1 hrs. x \$28.67 hourly wage rate) + (1 pg. x \$0.15))].

Under the final rule, the cost savings for posting gravimetric sampling data in underground coal mines changes each year until the third year, after which it remains constant. The Agency estimated costs that will be incurred over a 10-year period by multiplying each year's costs (excluding the costs in the first year) by a discount factor. MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at annual cost saving estimates of: \$3,527 for mines with 1-19 employees; \$37,423 for mines with 20-500 employees; and \$3,997 for mines with 501+ employees.

Surface Coal Mine Operators

For the first year that the final rule is in effect, and every year thereafter, the number of sampling data postings at surface coal mines increase by 9,878, of which: 3,564 postings are in mines with 1-19 employees; 6,076 postings are in mines with 20-500 employees; and 238 postings are in mines with 501+ employees.

First Year of the Final Rule, and Every Year Thereafter

MSHA estimates that for the first year that the rule is in effect, and every year thereafter, costs for posting gravimetric sampling data at surface operations are \$25,100. Costs for each mine size are shown below:

- \$9,056 in mines with 1-19 employees [3,564 postings x ((0.1 hrs. x \$23.91 hourly wage rate) + (1 pg. x \$0.15))];
- \$15,439 in mines with 20-500 employees [6,076 postings x ((0.1 hrs. x \$23.91 hourly wage rate) + (1 pg. x \$0.15))]; and
- \$605 in mines with 501+ employees [238 postings x ((0.1 hrs. x \$23.91 hourly wage rate) + (1 pg. x \$0.15))].

Status Change Reports

If there is a change in operational status that affects the respirable dust sampling requirements, the operator shall report the change in operational status of the mine to the MSHA District Manager or to any other MSHA office designated by the District Manager: under final

§ 70.212(a) for MMU and DA sampling by underground coal mine operators; under § 90.210 for part 90 miner sampling by underground and surface coal mine operators; and under final § 71.209(a) for DWP sampling by surface coal mine operators. Status changes shall be reported in writing or electronically within 3 working days after the status change has occurred.

Operators are currently required to provide status change reports to MSHA District Managers under existing §§ 70.220 and 90.220 for underground coal mine operators, and existing § 71.220 for surface coal mine operators. The number of status change reports generated as a result of the final rule is expected to be small; the costs for these final standards are minimal and not included in this analysis.

Summary

Table IV-25 shows that the first year costs for sampling with a gravimetric sampler results in a net cost saving of approximately \$1.3 million for underground coal mine operators, and increased costs of approximately \$1.8 million for surface coal mine operators. For underground coal mine operators' costs for sampling, transmitting samples and posting sampling data are different until the third year, when they become constant. Thus, these costs in Table IV-25 were determined by taking the present value for each year for a 10-year period and then summing the present values. The summed amount was annualized over a 10-year period at a 7 percent discount rate using a factor of 0.142.

Table IV-25: First Year Cost Estimates for Gravimetric Sampling ^a

Requirements	1-19	20-500	501+	Total
Underground Coal Operators				
Purchase Units	\$0	\$0	\$0	\$0
List DWPs	\$95	\$544	\$213	\$852
Sampling	-\$95,386	-\$1,011,938	-\$108,078	-\$1,215,402
Transmit Samples	-\$7,530	-\$73,684	-\$7,870	-\$89,084
Post Sampling Data: Provide to Part 90 Miner	-\$3,527	-\$37,423	-\$3,997	-\$44,947
Total	-\$106,348	-\$1,122,501	-\$119,732	-\$1,348,581
Surface Coal Operators				
Purchase Units	\$347,200	\$628,600	\$7,700	\$983,500
List DWPs	\$13,652	\$10,990	\$100	\$24,742
Sampling	\$267,585	\$456,186	\$17,869	\$741,640
Transmit Samples	\$19,932	\$30,942	\$1,212	\$52,086
Post Sampling Data: Provide to Part 90 Miner	\$9,056	\$15,439	\$605	\$25,100
Total	\$657,425	\$1,142,157	\$27,486	\$1,827,068

^a First Year Costs include: costs that occur in the first year that do not repeat every year plus the ongoing costs. Some costs in this table change in various years and then obtain equilibrium. For these costs, the present value was taken each year for a 10-year period and then summed. The sum was then annualized over a 10-year period at a 7 percent discount rate.

Table IV-26 shows that the annualized costs related to performing sampling with a gravimetric sampler results in a net cost saving estimate of approximately \$1.3 million for underground coal mine operators and an increased cost estimate of approximately \$1.1 million for surface coal mine operators. Underground coal mine operators' costs for sampling, transmitting samples and posting sampling data are different until the third year, when they become constant. Thus, these costs in Table IV-26 were determined by taking the present value for each year for a 10-year period and then summing the present values. The summed amount was annualized over a 10-year period at a 7 percent discount rate using a factor of 0.142.

Table IV-26: Annualized Cost Estimates for Gravimetric Sampling ^a

Requirements	1-19	20-500	501+	Total
Underground Coal Operators				
Purchase Units	\$0	\$0	\$0	\$0
List DWPs	\$34	\$118	\$51	\$203
Sampling	-\$95,386	-\$1,011,938	-\$108,078	-\$1,215,402
Transmit Samples	-\$7,530	-\$73,684	-\$7,870	-\$89,084
Post Sampling Data: Provide to Part 90 Miner	-\$3,527	-\$37,423	-\$3,997	-\$44,947
Total	-\$106,409	-\$1,122,927	-\$119,894	-\$1,349,230
Surface Coal Operators				
Purchase Units	\$84,717	\$153,378	\$1,879	\$239,974
List DWPs	\$3,003	\$2,419	\$31	\$5,453
Sampling	\$267,585	\$456,186	\$17,869	\$741,640
Transmit Samples	\$19,932	\$30,942	\$1,212	\$52,086
Post Sampling Data: Provide to Part 90 Miner	\$9,056	\$15,439	\$605	\$25,100
Total	\$384,293	\$658,364	\$21,596	\$1,064,253

^a Annualized Costs include: annualizing the first year costs and then adding the ongoing costs.

Using CPDMs at Underground Mines

Cost Estimates Incurred When Using a CPDM to Sample

Beginning 18 months after the effective date of the final rule, sampling with a CPDM is required for DO and ODOs for each MMU under final § 70.201(a) and (b)(1), and for each part 90 miner under final § 90.201(a).

Cost Estimates to Purchase Related Equipment When Using a CPDM to Sample

Final §§ 70.210(f) and 90.208(f) require that, if using a CPDM, all sample data file information collected and stored in the CPDM must be transmitted electronically to MSHA within 24 hours after the end of each sampling shift. In addition, final §§ 70.211(c) and 90.209(c) apply to operators who use a CPDM. Final § 70.211(c) requires the person certified in sampling to print, sign and post a paper record (dust data card) of the sample run on the mine

bulletin board within 12 hours after the end of each sampling shift. Final § 90.209(c) requires the person certified in sampling to print, sign and provide the paper record (dust data card) of the sample run to the part 90 miner within one hour after the start of the part 90 miner's next work shift. As a result of these provisions, MSHA estimates that some operators will need to purchase additional computers.

In the PREA, MSHA estimated that 75 percent of underground coal mine operators, in each mine size category, would have to purchase 1 additional computer and printer to process information generated by the CPDM. A commenter stated that because of the extensive requirements for sampling that would have been required by the proposed rule, a minimum of 5 laptop computers would be needed for downloading samples, recordkeeping, transferring data to MSHA and training. The final rule significantly reduces the amount of CPDM sampling that would have been required under the proposed rule. However, in consideration of the commenter's concern, the Agency is revising its estimates of the number of additional computers and printers that operators will need to purchase to comply with the final rule. For this analysis, MSHA estimates that 75 percent of underground coal operators that have a mine with 20 or more employees will purchase 2 additional computers and printers to process the information generated by the CPDM. Underground coal operators that have a mine with 1-19 employees are still assumed to need to purchase 1 additional computer and printer.

Final §§ 70.204(d) and 90.204(d) require that when CPDMs are used, a person certified in sampling or in maintenance and calibration follow the pre-operational examinations, testing and set-up procedures, and perform necessary external maintenance recommended by the manufacturer. In the PREA, MSHA determined that to perform the required monthly calibration on a CPDM, some operators would need to purchase a flow meter to conduct a flow audit (larger mines tend to have flow meters). For this analysis, the Agency retains this position.

MSHA estimates that the number of underground coal mine operators that will need computers and printers are: 61 mines with 1-19 employees (81 mines x 75 percent); 248 mines with 20-500 employees (331 mines x 75 percent); and 9 mines with 501+ employees (12 mines x 75 percent). MSHA estimates that it costs \$1,000 for a computer and printer, including ink and paper. Also, MSHA estimates that: 81 mines with 1-19 employees (all mines in this size group) and 83 mines with 20-500 employees (331 mines x 25 percent) need to purchase a flow meter. MSHA expects that all mines with 501+ employees currently have flow meters. MSHA estimates that a flow meter costs \$1,700. The flow meter that MSHA cites for this analysis is the Gilibrator Fast Response Flow Meter Calibrator. MSHA estimates a 5-year life for the computer, printer and flow meter. MSHA estimates that underground coal mine operators' first year costs to purchase computers, printers and flow meters when using CPDMs are \$853,800. Costs for each mine size are shown below:

Underground Coal Mine Operators:

- \$198,700 for mines with 1-19 employees [(61 mines x 1 computer and printer x \$1,000) + (81 mines x 1 flow meter x \$1,700)];
- \$637,100 for mines with 20-500 employees [(248 mines x 2 computers and printers x \$1,000) + (83 mines x 1 flow meter x \$1,700)]; and
- \$18,000 for mines with 501+ employees (9 mines x 2 computers and printers x \$1,000).

First year cost estimates were multiplied by an annualization factor of 0.244 based on a 7 percent discount rate to reflect a 5-year service life for the computer, printer and flow meter. MSHA estimates that annualized first year costs will be \$208,300 for underground coal mine operators.

Estimating the Number of CPDMs

Under final §§ 70.201(a), (b)(1), and 70.208(a), beginning 18 months after the effective date of the final rule, operators are required to use CPDMs to collect, each calendar quarter, 15 valid representative samples from the DO and ODOs in each MMU. Under final §§ 90.201(a) and 90.207(a), beginning 18 months after the effective date of the final rule, operators are required to use CPDMs to take 5 valid representative samples every calendar quarter from the work environment of each part 90 miner.

As noted in the discussion that follows, MSHA believes commenters overestimated the number of CPDMs needed to comply with the rule.

Commenters Have Overstated The Number Of CPDMs Needed Due To Maintenance And Reliability Concerns

One commenter stated that one mine with 18 MMUs that operates 2 shifts per day would need to purchase 108 CPDMs to comply with the proposed rule. According to the commenter, this mine would need 36 CPDMs per shift $[(18 \text{ MMUs per mine} \times 1 \text{ DO sample}) + (6 \text{ MMUs} \times 3 \text{ ODO samples}) \times 1 \text{ shift}]$. Since the mine operates two shifts per day and the CPDM needs to be charged for six hours after use, an additional 36 CPDMs would be needed for the second shift, for a total of 72 CPDMs for both shifts. Furthermore, the commenter stated that this mine would need to purchase an additional 36 CPDMs (50 percent of 72 units) to be used as spares to address potential reliability issues. Another commenter estimated that the proposed rule would result in the coal mining industry needing to purchase 25 percent more CPDMs to address “maintenance/reliability” concerns.

Another commenter calculated that more CPDMs would need to be purchased to account for shifts that could run over 12 hours and the need for backup CPDMs for failure and malfunctions. A different commenter stated that for 3 MMUs operating in the mine (1 longwall MMU and 2 MMUs using continuous mining machines), it would cost \$750,000 to purchase CPDMs. At a cost of \$15,775 per CPDM (assumes \$12,900 for the unit + \$2,875 for a five year warranty), this commenter would purchase 15.8 CPDMs for each MMU $[(\$750,000 / \$15,775 \text{ per CPDM}) / 3 \text{ MMUs}]$. Other commenters provided the number of CPDMs they would have to purchase under the proposal, but did not provide sufficient information to determine how many CPDMs would be needed for spares or how they arrived at their total estimated number of CPDMs.

The commenters have overstated the number of CPDMs needed to comply with the proposed rule based on their assessment that the CPDM is not a reliable instrument for sampling. As discussed in detail in Section III.C., Feasibility, of the preamble to the final rule, NIOSH has found the CPDM, which is approved under 30 CFR part 74, to be reliable. Also, the estimated failure rates reported by commenters are overstated. For example, many commenters interpreted the sampling status codes (previously referred to as “error codes”) displayed by the CPDM as device failures, which they are not. Moreover, as noted in the Feasibility section of the

preamble, the CPDM manufacturer has reported improvements in repair rates and in repair turnaround times. Average repair turnaround times declined from 26 days per repair in the first year following the product launch in May 2009, to 4.7 days in 2011. Also, repair rates are expected to improve with experience gained in the area of quality control.

Furthermore, the final rule reduces from the proposed rule the number of CPDM samples that operators need to collect, which will provide time within each sampling period for operators to respond to potential equipment breakdowns. For example, under the proposed rule, an operator would have been required to sample every DO on every production shift with a CPDM. However, the final rule requires the operator to collect valid representative samples only on 15 consecutive shifts per quarter from each DO using the CPDM.

In light of the improved reliability and repair turnaround times for the CPDM noted above and changes in the final rule that reduce the number of required CPDM samples, MSHA estimates that fewer CPDMs will be needed under the final rule than were estimated under the proposed rule. In addition, MSHA estimates that fewer operators will buy the extended warranty when purchasing a CPDM. In the PREA, MSHA estimated that each operator would buy a 5-year extended warranty with each CPDM purchase. MSHA's assumption of an extended warranty purchase for each CPDM purchase was based in large part on concerns about CPDM reliability, which could cause units to be returned to the manufacturer for repairs.

As discussed in detail in Section III.C., Feasibility, of the preamble to the final rule, NIOSH found the CPDM, which is approved under 30 CFR part 74, to be reliable. Also, the estimated failure rates reported by commenters are overstated. For example, many commenters misinterpreted the codes displayed by the CPDM as device failures, which they are not. As noted in the Feasibility section of the preamble, the CPDMs' manufacturer has reported improvements in repair rates and in repair turnaround times. Also, repair rates are expected to improve with experience gained in the area of quality control. Changes in the final rule reduce the number of CPDM operator samples and provide operators with time within each sampling period to respond to potential equipment breakdowns. MSHA now considers that assumption to be an overestimate. Some operators may forgo the purchase of an extended warranty, while others may decide that it is needed. This REA assumes that an extended 5-year warranty will be purchased for 25 percent of the CPDM units that MSHA estimates will be purchased by operators to comply with the requirements of the final rule.

Revising the Number Of CPDMs Needed In Underground Coal Mines

One commenter estimated that the proposed rule would result in the underground coal mining industry needing to purchase 4,405 CPDMs. This commenter assumed that 5 CPDMs are needed per MMU (2 CPDMs for DO sampling + 2 CPDMs for ODO sampling + 1 CPDM to address reliability concerns). Thus, based on 881 MMUs that MSHA used in the proposed rule, the underground coal industry would need 4,405 CPDMs (881 MMUs x 5 CPDMs per MMU).

In the PREA, MSHA estimated that underground coal mine operators would need to purchase 2,655 CPDMs to comply with the proposed rule. Approximately 93 percent of these CPDMs would have been needed for DO, ODO, and part 90 miner sampling under the proposed rule. MSHA assumed that 1 DO sample would have been taken per MMU for every production shift. Since a CPDM needs six hours to recharge after it has been used, MSHA assumed that MMUs operating one shift per day would need 1 CPDM to sample the DO, and MMUs operating

two or more shifts per day would need 2 CPDMs to sample the DO. The Agency assumed that MMUs operating 3 shifts per day would use the same CPDM on the first and third shift. For the number of CPDMs needed for ODO sampling, MSHA assumed that 1 CPDM would be needed per mine in mines with 1-19 employees, and 2 CPDMs would be needed per mine in mines with 20 or more employees. The remaining small percentage of CPDMs that MSHA estimated that operators would need (7 percent) was allocated to sampling when supplementary controls under proposed § 70.208(h) were used. In addition, at the time the proposed rule was published, approximately 120 CPDMs had been sold by the manufacturer of the CPDM. In the PREA, MSHA assumed that when the rule became final, approximately 200 CPDMs would have been purchased by mine operators and these units could be used as spare CPDMs.

MSHA received comments on the proposed rule stating that the estimated number of CPDMs needed was understated. In addressing the comment, MSHA discovered an error in the proposed rule estimates for the number of CPDMs that would have been required. The error was the result of underestimating the number of CPDMs required to sample Other Designated Occupations (ODOs). The total undiscounted cost for the initial CPDM purchase in the proposed rule was \$34.2 million. MSHA revises the estimate of the number of CPDMs needed to comply with the proposed rule to 4,203 and the cost to \$54.1 million due to correcting the error in the original calculation. Additionally, annual maintenance costs under the proposed rule for the CPDMs have been revised upward to \$5.4 million. The changes increased the revised CPDM cost estimate to \$59.5 (\$54.1 + \$5.4) million. The final rule costs for CPDMs are \$24.9 million with annual maintenance costs of \$2.4 million, for a total of \$27.3 million. This results in a decrease of 54 percent or a \$32.2 (\$59.5-\$27.3) million cost reduction for the CPDMs from the revised proposed rule cost estimate to the final rule cost estimate. These cost reductions are due to fewer CPDMs needed for sampling as a result of the final rule requiring less sampling than the proposed rule.

Under the proposed rule, sampling would have been required on every production shift for the DO, and for each production shift for 14 consecutive days for each ODO per quarter. The final rule requires, under final § 70.208, that both DO and ODO sampling be done quarterly, on consecutive normal production shifts until 15 valid representative samples are taken. For mines that have more than one MMU, sampling on each MMU can be done either simultaneously or on different shifts; however, similar ODO types that are on the same MMU must be sampled at the same time. For example, if a mine with blowing face ventilation has an MMU with 2 pieces of face haulage equipment (e.g., shuttle car ODOs (SC-ODOs)) on the same MMU, the shuttle car ODOs must be sampled at the same time. However, a Roof Bolter ODO (RB-ODO) on that same MMU, since it is a different type of ODO, is required to be sampled at a different time than the 2 SC-ODOs. In response to comments, the final rule reduces the amount of CPDM sampling from the proposal. Therefore, MSHA has revised its method for estimating the number of CPDMs needed under the final rule.

In deriving an estimate for the number of CPDMs that operators will need to purchase to comply with the final rule, MSHA made the following assumptions.

- Whenever ODO sampling involves face haulage equipment, it is referred to below as shuttle car ODO (SC-ODO) sampling. MSHA realizes that face haulage equipment includes more than just shuttle cars (e.g., scoops, ram cars). However, since shuttle cars are the most common face haulage equipment used, MSHA uses the shuttle car

ODOs to represent ODO sampling for face haulage equipment for simplicity in the discussion.

- Although the final rule requires 15 valid representative samples for each DO and ODO entity type sampled per quarter, this analysis uses 25 samples for each DO and ODO.¹³ This accounts for samples that do not achieve the production level required by the final rule under the definition of normal production shift, and samples that may be voided by MSHA for other reasons.
- Although there are 90 sampling days in a quarter and operators can use all 90 days if needed, MSHA's estimate of CPDMs is based on a sampling period when no mine should need more than 75 sampling days in a quarter to conduct sampling. This shorter time period provides operators extra days in the quarter to address any maintenance issues with CPDMs; and flexibility for any additional sampling needed when an overexposure occurs.
- Based on the experience of MSHA's field staff, MSHA assumed that 50 percent of mines use blowing face ventilation and 50 percent of mines use exhaust face ventilation.
- In the PREA under proposed § 75.332, MSHA estimated that 50 MMUs were part of super sections.¹⁴ A commenter stated that this estimate was too low and provided data showing that there were 265 MMUs in mines on super sections. MSHA reexamined its estimate and determined that there were at least 100 super sections, and that the commenter's estimate of MMUs as part of super sections was closer to a more realistic figure. Therefore, MSHA divided the 265 MMUs by the total number of MMUs for the approximate same time period noted by the commenter to arrive at 28.4 percent and then multiplied this percentage by the total number of MMUs (881 MMUs) to arrive at an estimate of 250 MMUs in mines with super sections, which is the number used in this analysis. Mines with 20-500 employees were apportioned 90 percent of the MMUs (or 225 MMUs), and mines with 501+ employees were apportioned the remaining 10 percent (or 25 MMUs).
- Mines with 1-19 employees operate 1 shift per day. MMUs in mines with 20 or more employees operate, on average, 2 shifts per day.
- An operator will need to sample 1 DO and 1 RB-ODO each quarter on a non-longwall MMU in a mine using exhaust face ventilation. Since different entity types must be sampled at different times, 1 CPDM per shift is sufficient to sample these different entity types each quarter for a non-longwall MMU in a mine using exhaust face ventilation.

¹³ U.S. Department of Labor, MSHA, 2012, Number of Shifts Required To Meet Specified Production Criteria, Statistical Methods and Analysis, , March 1, 2012; and U.S. Department of Labor, MSHA, 2012, Addendum to Number of Shifts Required To Meet Specified Production Criteria, Statistical Methods and Analysis, March 16, 2012.

¹⁴ A super section is defined as two sets of mining equipment operating simultaneously and sharing a common dumping point on the same section, with each set being ventilated by a separate split of air.

- An operator will need to sample 1 DO, 1 RB-ODO, and 2 SC-ODOs each quarter on a non-longwall MMU in a mine using blowing face ventilation. Since the same entity type must be sampled at the same time (in this case the 2 SC-ODOs), then 2 CPDMs per shift are needed to sample the entity types each quarter for a non-longwall MMU in a mine using blowing face ventilation.
- An operator will need to sample 1 DO, 1 Jack Setter, and 1 Mechanic each quarter on a longwall MMU. Since different entity types must be sampled at different times, 1 CPDM per shift is sufficient to sample these entity types each quarter for a longwall MMU.
- Operators that have MMUs that are part of a super section will need to sample 1 DO, 1 RB-ODO, and 3 SC-ODOs. Since the same entity types must be sampled at the same time (in this case the 3 SC-ODOs), then 3 CPDMs per shift are needed to sample the entity types for MMUs on a super section. The entity types that need to be sampled on a super section are the same as those on an MMU in a mine using blowing face ventilation, except that 1 additional shuttle car ODO needs to be sampled on the super section. Thus, a super section needs 1 more CPDM than an MMU in a mine using blowing face ventilation.

Based on the above assumptions, MSHA estimates that operators will need to purchase 1,827 CPDMs to comply with the final rule, of which 125 CPDMs will be purchased by mines with 1-19 employees; 1,578 CPDMs will be purchased by mines with 20-500 employees; and 124 CPDMs will be purchased by mines with 501+ employees. The derivation of the number of CPDMs is shown below in: Table IV-27 for mines with 1-19 employees; Table IV-28 for mines with 20-500 employees; and Table IV-29 for mines with 501+ employees.

Table IV-27: Estimate of the No. of CPDMs for Mines with 1-19 Employees

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
MMUs per Mine with 1-19 Employees.	No. of Shifts MMU Runs per Day	No. of CPDMs Needed per shift in a Mine with Exhaust Ventilation and the No. of MMUs Listed in Col. (a)	No. of CPDMs Needed per shift in a Mine with Blowing Ventilation and the No. of MMUs Listed in Column (a)	No. of Mines That Use Exhaust Ventilation	No. of Mines That Use Blowing Ventilation	No. of CPDMs Needed in Mines with Exhaust Ventilation (col. b x c x e)	No. of CPDMs Needed in Mines with Blowing Ventilation (col. b x d x f)	Total No. of CPDMs (col. g + h)
1	1	1	2	39	39	39	78	117
1	2	1	2	2	1	4	4	8
Total 1-19				41	40			125

Table IV-28: Estimate of the No. of CPDMs for Mines with 20-500 Employees

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
MMUs per Mine with 20-500 Employees	No. of Shifts MMU Runs per Day	No. of CPDMs Needed per shift in a Mine with Exhaust Ventilation and the No. of MMUs Listed in Col. (a)	No. of CPDMs Needed per shift in a Mine with Blowing Ventilation and the No. of MMUs Listed in Column (a)	No. of Mines with Exhaust Ventilation	No. of Mines with Blowing Ventilation	No. of CPDMs Needed in Mines with Exhaust Ventilation (col. b x c x e)	No. of CPDMs Needed in Mines with Blowing Ventilation (col. b x d x f)	Total No. of CPDMs (col. g + h)
1	2	1	2	65	65	130	260	390
2	2	1	2	49	48	98	192	290
3	2	2	3	18	18	72	108	180
4	2	2	4	18	18	72	144	216
5	2	2	4	5	4	20	32	52
6	2	3	5	6	5	36	50	86
7	2	3	6	1	1	6	12	18
8	2	4	7	2	2	16	28	44
9	2	4	8	0	0	0	0	0
10	2	4	8	2	2	16	32	48
11	2	5	9	1	1	10	18	28
16	2	7	13	0	0	0	0	0
Sub-total				167	164	0	0	1,352
	No. of Shifts MMU Runs per Day	No. of Additional CPDMs Needed for a Super Section	No. of MMUs in Super Sections in Mines	No. of MMUs in Super Sections Divided by 2 ^a				Total No. of Additional CPDMs for Super Sections (col. b x c x e)
Super Sections	2	1	225	113				226
Total 20-500								1,578

^a Assume 2 MMUs per super section can be sampled in a quarter with 1 additional CPDM.

Table IV-29: Estimate of the No. of CPDMs for Mines with 501+ Employees

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
MMUs per Mine with 501+ Employees	No. of Shifts MMU Runs per Day	No. of CPDMs Needed per shift in a Mine with Exhaust Ventilation and the No. of MMUs Listed in Col. (a)	No. of CPDMs Needed per shift in a Mine with Blowing Ventilation and the No. of MMUs Listed in Column (a)	No. of Mines with Exhaust Ventilation	No. of Mines with Blowing Ventilation	No. of CPDMs Needed in Mines with Exhaust Ventilation (col. b x c x e)	No. of CPDMs Needed in Mines with Blowing Ventilation (col. b x d x f)	Total No. of CPDMs (col. g + h)
1	2	1	2	0	0	0	0	0
2	2	1	2	0	0	0	0	0
3	2	2	3	0	0	0	0	0
4	2	2	4	1	1	4	8	12
5	2	2	4	1	1	4	8	12
6	2	3	5	1	1	6	10	16
7	2	3	6	1	1	6	12	18
8	2	4	7	0	0	0	0	0
9	2	4	8	1	0	8	0	8
10	2	4	8	1	0	8	0	8
11	2	5	9	1	0	10	0	10
16	2	7	13	1	0	14	0	14
Sub-total				8	4	0	0	98
	No. of Shifts MMU Runs per Day	No. of Additional CPDMs Needed for a Super Section	No. of MMUs in Super Sections in Mines	No. of MMUs in Super Sections Divided by 2 ^a				Total No. of Additional CPDMs for Super Sections (col. b x c x e)
Super Sections	2	1	25	13				26
Total 501+								124

^a Assume 2 MMUs per super section can be sampled in a quarter with 1 additional CPDM.

Cost Estimates for the Number of CPDMs

In the PREA, MSHA assumed the life of a CPDM unit to be five years and that all operators would purchase a five-year warranty with each unit purchased. Thus, in the PREA, MSHA estimated the total cost for each CPDM unit sold to be \$12,875 (\$10,000 for the CPDM unit + \$2,875 for a 5-year extended warranty).

Commenters stated that the price of a CPDM unit is higher than \$10,000 and that, excluding warranty costs, ranges from \$12,000 to \$13,000. Most commenters stated that the CPDM price is \$12,900. The CPDM manufacturer has stated in written testimony that the cost to purchase a single CPDM, excluding any warranty program, is \$12,900 and the cost for a 5-year warranty is \$2,875. The CPDM manufacturer also provided written testimony that it anticipates a minimum five-year life for the CPDM. As a result, MSHA is revising its sales price per unit from \$10,000 to \$12,900. As previously noted and based on comments on the reliability of the CPDM from NIOSH and the manufacturer, which are discussed in the preamble of the final rule, MSHA considers that the assumption in the PREA that all operators will purchase an extended warranty with each unit purchased to be an overestimate. This analysis assumes warranty costs for 25 percent of the CPDM units that MSHA estimates are needed to comply with the final rule.

Although the CPDM units are not required to be used until 18 months after the effective date of the rule, MSHA assumes in this analysis that operators will start purchasing the CPDM units within the first year that the rule is in effect. MSHA estimates that first year costs for underground coal mine operators to purchase CPDMs are \$24.9 million. Costs for each mine size are shown below:

Underground coal mine operators

- \$1.7 million in mines with 1-19 employees $[(125 \text{ CPDMs} \times \$12,900) + (125 \text{ CPDMs} \times 0.25 \times \$2,875)]$;
- \$21.5 million in mines with 20-500 employees $[(1,578 \text{ CPDMs} \times \$12,900) + (1,578 \text{ CPDMs} \times 0.25 \times \$2,875)]$; and
- \$1.7 million in mines with 501+ employees $[(124 \text{ CPDMs} \times \$12,900) + (124 \text{ CPDMs} \times 0.25 \times \$2,875)]$.

First year cost estimates were annualized over 5 years by multiplying them by a factor of 0.244 based on a 7 percent discount rate to arrive at an annualized cost estimate of approximately \$6.1 million for underground coal mine operators.

MSHA's estimate of costs to purchase CPDMs could be lower because of: volume discounts offered by the CPDM manufacturer; extending the life of the CPDM beyond 5 years; and sharing CPDMs by smaller mines. MSHA has not estimated lower CPDM purchase costs because the Agency does not have sufficient information to perform the calculations. Also, the following is noteworthy:

- The CPDM manufacturer commented that the company will accept volume discounts for CPDMs bought through one purchase order. It may be feasible for a company to have one purchase order for CPDMs for all the mines they own and thus take advantage of a lower price per CPDM through the volume discount program.

- This analysis assumes that the CPDM has a life of 5 years, which means that a coal mine operator purchasing CPDMs to comply with the final rule will need to purchase them again 5 years after initial purchase. However, the manufacturer of the CPDM has commented that the company expects the “minimum” life of the CPDM to be 5 years. If, on average, the life of the CPDM in the coal mining industry is longer than 5 years, the re-purchase of CPDMs can be extended beyond five years resulting in lowering the estimate of annualized costs for the CPDMs.
- Smaller mines located close to each other may decide to share CPDM units. Since the final rule requires sampling until 15 valid representative DO and ODO samples are taken per quarter, there will be more non-sampling days in a quarter in smaller mines compared to larger mines because smaller mines have fewer MMUs to sample. Therefore, smaller mines located near each other are in a better position to share CPDMs than larger mines. Also, smaller mines may choose to contract out dust sampling if they find it less expensive than purchasing and maintaining CPDMs. MSHA could not develop any costs for such services because they are not available since the CPDM is not currently allowed for compliance sampling.

Cost Estimates for Purchasing CPDM Filters

Final § 70.208(a) requires underground coal mine operators to sample each DO and ODO quarterly until 15 valid representative samples are taken. However, due to the definition of normal production shift under the final rule, MSHA estimates that 25 samples will need to be taken to get 15 valid representative samples.¹⁵ Therefore, MSHA used 25 rather than 15 samples to derive filter costs related to CPDM sampling. A new CPDM filter is needed with each sample taken. The estimate of the number of samples taken per quarter on an MMU is based on the type of MMU and conditions in the mine. MSHA estimates that:

- 50 samples per quarter will be taken on a non-longwall MMU in a mine using exhaust face ventilation [25 samples for 1 DO + 25 samples for 1 RB-ODO];
- 100 samples per quarter will be taken on a non-longwall MMU in a mine using blowing face ventilation [25 samples for 1 DO + 25 samples for 1 RB-ODO + 50 samples for 2 SC-ODOs (25 samples per SC-ODO)]; and
- 75 samples per quarter will be taken on a longwall MMU [25 samples for 1 DO + 25 samples for 1 (Jack Setter) JS-ODO + 25 samples for 1 Mechanic].
- 25 samples per quarter will be taken for one additional SC-ODO sampled on an MMU on a super section. An operator that has an MMU on a super section will sample 1 DO, 1 RB-ODO and 3 SC-ODOs. Thus, sampling an MMU on a super section is similar to an MMU in a mine using blowing face ventilation, with the

¹⁵ U.S. Department of Labor, MSHA, 2012, Number of Shifts Required To Meet Specified Production Criteria, Statistical Methods and Analysis, March 1, 2012; and U.S. Department of Labor, MSHA, 2012, Addendum to Number of Shifts Required To Meet Specified Production Criteria, Statistical Methods and Analysis, March 16, 2012.

exception that 1 additional SC-ODO will be sampled per quarter on the MMU on a super section (25 samples for 1 additional SC-ODO).

The price per filter decreases as the volume ordered increases. Since the proposed rule would have required sampling the DO on every production shift, this would have involved a significant amount of sampling. In the PREA, MSHA used \$5.50 as the cost of a filter to account for operators purchasing large volumes of filters to take advantage of volume discounts. One commenter indicated a price of \$6.50 per CPDM filter. Based on this comment and since the final rule reduces the amount of CPDM operator sampling, MSHA has increased the price per filter to \$6.50 for this analysis of the final rule. In addition, since sampling with the CPDM is not required until 18 months after the final rule is in effect and will continue thereafter, the filter costs are multiplied by a discount factor of 0.859 based on a 7 percent discount rate.

In Table IV-30 below MSHA estimates that the annual cost for operators to purchase filters to perform CPDM sampling is \$1.6 million, of which \$135,100 is accounted for by mines with 1-19 employees; \$1.3 million is accounted for by mines with 20-500 employees; and \$168,100 is accounted for by mines with 501+ employees.

Table IV-30: Annual Cost Estimates for CPDM Filters

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Type of Mining and Ventilation Used in Mine	No. of Samples per MMU Type	Sampling Quarters per Yr.	Samples per Yr. per MMU	No. of MMUs	No. of MMUs in Super Sections	No. of Samples per Yr.	Cost per Filter	Annual-ization Factor	Annual Filter Costs for Sampling with CPDMs ^a
Mines with 1-19 Employees									
Non-LW MMUs Using Exhaust Face Ventilation	50	4	200	41		8,200			
Non-LW MMUs Using Blowing Face Ventilation	100	4	400	40		16,000			
Subtotal				81		24,200	\$6.50	0.859	\$135,121
Mines with 20-500 Employees									
Non-LW MMUs Using Exhaust Face Ventilation	50	4	200	343		68,600			
Non-LW MMUs Using Blowing Face Ventilation	100	4	400	343		137,200			
LW-MMUs	75	4	300	22		6,600			
Additional Sampling at MMUs that are Part of Super Sections ^b	25	4	100		225	22,500			
Subtotal				708		234,900	\$6.50	0.859	\$1,311,564
Mines with 501+ Employees									
Non-LW MMUs Using Exhaust Face Ventilation	50	4	200	36		7,200			
Non-LW MMUs Using Blowing Face Ventilation	100	4	400	36		14,400			
LW-MMUs	75	4	300	20		6,000			
Additional Sampling at MMUs that are Part of Super Sections ^b	25	4	100		25	2,500			
Subtotal				92		30,100	\$6.50	0.859	\$168,063
Total				881	250	289,200			\$1,614,748

^a Col. j = col. g x col. h x col. i.

^b The 250 MMUs in Super Sections in Column f are included in the 881 MMUs in column e.

In addition to the above filter costs, there is also a cost for filters to sample part 90 miners. There are 66 part 90 miners at underground coal mines: None are in mines with 1-19 employees; 47 are in mines with 20-500 employees; and 19 are in mines with 501+ employees. Each part 90 miner is sampled with the CPDM for 5 consecutive shifts per quarter. Since part 90 miner sampling is not specifically tied to production, MSHA expects that operators will be able to obtain valid samples when taking the 5 samples. Thus, annual samples for part 90 miners are: 940 samples in mines with 20-500 employees (47 part 90 miners x 5 samples x 4 quarters per year); and 380 samples in mines with 501+ employees (19 part 90 miners x 5 samples x 4 quarters per year). Cost per CPDM filter is \$6.50. In addition, since sampling with the CPDM is not required until 18 months after the effective date of the final rule and will continue thereafter, the filter costs are multiplied by a discount factor of 0.859 based on a 7 percent discount rate. MSHA estimates that annual filter costs for part 90 miners at underground coal mines are \$7,375. Costs for each mine are shown below.

Underground coal mine operators

- \$5,248 in mines with 20-500 employees (940 samples x \$6.50 per filter x 0.859); and
- \$2,122 in mines with 501+ employees (380 samples x \$6.50 per filter x 0.859).

Cost Estimates for CPDM Annual Maintenance

Final §§ 70.204(d) and 90.204(d) require that when CPDMs are used, a person certified in sampling or in maintenance and calibration must follow the examination, testing, and set-up procedures recommended by the manufacturer. According to the manufacturer's recommendations, the following monthly maintenance is required: clean cyclone and inlet tubing; perform a sample line leak check; and perform a flow audit procedure.

There were no comments on the derivation of the CPDM annual maintenance costs. Therefore, the method used in the PREA to estimate annual maintenance costs is also used in this analysis, with the exception that hourly wage rates have been updated. For underground coal mines, MSHA estimates that monthly maintenance by a certified person, earning \$33.23 per hour, takes 45 minutes (0.75 hours) [35 minutes to clean the cyclone and inlet tubing; 5 minutes for a sample line leak check; and 5 minutes for a flow audit]. Therefore, the annual cost to perform monthly maintenance on a CPDM is approximately \$299 (12 mos. x 0.75 hrs. x \$33.23 hourly wage rate). In addition, the manufacturer recommends that a calibration audit be performed on the CPDM once a year at a cost of approximately \$33 (1 hr. for audit x \$33.23 hourly wage rate).

MSHA expects that parts on the CPDM unit may need to be replaced periodically. Manufacturer costs for high-end replacement parts range from \$200 for a front case assembly to \$1,300 for the LED cap lamp assembly. Low-end replacement parts, such as peel-away overlay clear covers that protect the glass showing the CPDM read out, a grit pot, or detachable power cord, each cost less than \$40. MSHA does not expect that each CPDM will need all these items replaced annually. As noted earlier, testing by NIOSH indicates that these devices are very reliable and durable. However, as these devices are used in the mining environment, they will be damaged and replacement parts will be needed. As a conservative estimate, MSHA projects \$1,000 for annual replacement parts and shipping, which is the same amount used in the PREA. However, since mines with 1-19 employees have fewer MMUs per mine (most have 1 MMU per

mine) and the final rule requires less occasions of sampling than the proposed rule (sampling required quarterly under the final rule rather than every production shift for DOs), there is less use of the CPDM and therefore, MSHA expects average annual costs for replacement parts and shipping for these mines will be half (or \$500) of what it is for larger mines.

Thus, MSHA estimates that total annual maintenance costs for a CPDM are: \$832 (\$299 + \$33 + \$500) for mines with 1-19 employees; and \$1,332 (\$299 + \$33 + \$1,000) for mines with 20 or more employees. Since sampling with the CPDM is not required until 18 months after the final rule is in effect and will continue thereafter, the annual maintenance costs are multiplied by a discount factor of 0.859 based on 7 percent.

MSHA estimates that underground coal mine operators' costs to perform annual CPDM maintenance are \$2.0 million. Costs for each mine size are shown below:

Underground Coal Mine Operators

- \$89,336 for mines with 1-19 employees (125 CPDMs x \$832 x 0.859);
- \$1,805,529 for mines with 20-500 employees (1,578 CPDMs x \$1,332 x 0.859); and
- \$141,879 for mines with 501+ employees (124 CPDMs x \$1,332 x 0.859).

Cost Estimates for Before Shift CPDM Maintenance

Based on the manufacturer's recommendations, after the CPDM has been used on a shift and before it can be used again, the Tapered Element Oscillating Microbalance (TEOM®) filter must be replaced; and the grit pot, mass transducer area, and sample lines must be cleaned. In addition, the CPDM has to be programmed before each shift on which it is used. MSHA estimates that it takes a certified person, earning \$33.23 per hour, 15 minutes (0.25 hours) to perform the above tasks. The maintenance will be performed before every shift on which a CPDM will be used. There were no comments on the derivation of these CPDM maintenance costs in the proposed rule. Therefore, the method used in the PREA to estimate maintenance costs on CPDMs before the shift begins is used in this analysis, with the exception that hourly wage rates have been updated.

Since a new filter must be used each time a CPDM is used for sampling, the estimate of the number of samples per year shown above in the table used to derive the filter costs can be used as the estimate of the number of times per year that before-shift maintenance will be performed on CPDMs. The number of samples per year by mine size are: 24,200 samples in mines with 1-19 employees; 234,900 samples in mines with 20-500 employees; and 30,100 samples per year in mines with 501+ employees. In addition, as noted above, the number of annual part 90 samples is 940 samples in mines with 20-500 employees; and 380 samples in mines with 501+ employees. Thus, the total annual number of samples is: 24,200 samples in mines with 1-19 employees; 235,840 samples in mines with 20-500 employees; and 30,480 in mines with 501+ employees. Since sampling with the CPDM is not required until 18 months after the final rule is in effect and will continue thereafter, the before shift maintenance costs are multiplied by a discount factor of 0.859 based on a 7 percent discount rate.

MSHA estimates that underground coal mine operators' annual costs to perform before shift CPDM maintenance are \$2.1 million. Costs for each mine size are shown below:

Underground Coal Mine Operators

- \$172,695 for mines with 1-19 employees (24,200 times annually that before shift maintenance is performed x 0.25 hrs. x \$33.23 hourly wage x 0.859);
- \$1,682,988 for mines with 20-500 employees (235,840 times annually that before shift maintenance is performed x 0.25 hrs. x \$33.23 hourly wage x 0.859); and
- \$217,510 for mines with 501+ employees (30,480 times annually that before shift maintenance is performed x 0.25 hrs. x \$33.23 x 0.859).

Respirable Dust Samples; Transmission by Operator

Cost Estimates to Validate, Certify, and Transmit Electronically CPDM Data to MSHA

Final §§ 70.210(f) and 90.208(f) apply when operators use CPDMs to sample. These standards require that within 24 hours after the end of each sampling shift, the person certified in sampling must validate, certify, and transmit electronically to MSHA data file information collected and stored in the CPDM, including the sampling status conditions encountered when sampling.

For underground coal mine operators, the cost of the computer needed to download the sampling data from the CPDM and transmit the data to MSHA was estimated previously. MSHA estimates that validating, certifying, and uploading the CPDM data to a computer and then transmitting it electronically to MSHA takes a certified person, earning \$33.23 per hour, 6 minutes (0.1 hours). The annual number of CPDM samples estimated above when deriving costs for the before shift CPDM maintenance can be used to derive costs for this requirement because every sample must be validated, certified, and transmitted to MSHA within 24 hours after the end of each sampling shift by a certified person. Since sampling with the CPDM is not required until 18 months after the final rule is in effect and will continue thereafter, the costs to validate, certify and transmit are multiplied by a discount factor of 0.859 based on 7 percent.

MSHA estimates that underground coal mine operators' annual cost to validate, certify, and transmit CPDM sampling data to MSHA is \$829,300. Costs for each mine size are shown below:

Underground Coal Mine Operators

- \$69,078 for mines with 1-19 employees (24,200 samples per yr. x 0.1 hrs. x \$33.23 hourly wage x 0.859);
- \$673,195 for mines with 20-500 employees (235,840 samples per yr. x 0.1 hrs. x \$33.23 hourly wage x 0.859); and
- \$87,004 for mines with 501+ employees (30,480 samples per yr. x 0.1 hrs. x \$33.23 hourly wage x 0.859).

Respirable Dust Samples; Report to Operator: Posting

Cost Estimates to Sign and Post CPDM Sampling Data and Provide Information to Part 90 Miners

Final §§ 70.211(c) and 90.209(c) apply to operators who use a CPDM. Final § 70.211(c) requires the person certified in sampling to print, sign and post on the mine bulletin board within 12 hours after the end of each sampling shift a paper record (dust data card) of the sample run.

Final § 90.209(c) requires the operator to provide the paper record (dust data card) of the sample run to each part 90 miner.

Under final §§ 70.211(b) and 90.209(a) the sampling data must include: the mine identification number; the location within the mine from which the sample was taken; the concentration of respirable dust, expressed as an equivalent 8-hour concentration reported and stored for each sample; sampling status conditions encountered for each sample; the shift length; and for the part 90 miner the MSHA Individual Identification Number. MSHA expects that a copy of the printout will be posted or provided to the part 90 miner to satisfy the requirements of this provision.

Final § 70.201(e) requires the operator to make a record showing the length of each production shift for each MMU, retain the records for at least six months, and make them available for inspection by authorized representatives of the Secretary and the miners' representative and submit them to the District Manager when requested in writing. Final § 90.201(f) requires the operator to make a record showing the length of each shift for each part 90 miner, retain the records for at least six months, and make them available for inspection by authorized representatives of the Secretary, and submit them to the District Manager when requested in writing.

MSHA assumes that operators will record the shift length from the Dust Data Card into a book to comply with final §§ 70.201(e) and 90.201(f) when they print out the Dust Data Card. The costs for the computer and printer needed to download the sampling data from the CPDM and print out the Dust Data Cards were estimated previously.

Final § 70.211(b) requires the operator to post an MSHA report on the mine bulletin board and final § 90.209(b) requires the operator to provide a copy of the MSHA report to the part 90 miner. Posting of the MSHA report under final § 70.211(b) and the paper record (Dust Data Card) of the sample run under final § 70.211(c) can be done at the same time. Similarly, providing the part 90 miner with the MSHA report under final § 90.209(b) and the paper record (Dust Data Card) of the sample run under final § 90.209(c) can be provided to the part 90 miner at the same time.

The annual number of CPDM samples estimated above when deriving costs for the before shift CPDM maintenance can be used to derive costs to print, sign and post, or give the part 90 miner the sampling data. MSHA estimates that a person certified in sampling, earning \$33.23 an hour, takes 10 minutes (0.1667 hours) to print, sign and post the data. MSHA also estimates it will cost \$0.15 to make a copy of each printout. Since sampling with the CPDM is not required until 18 months after the final rule is in effect and will continue thereafter, the annual maintenance costs are multiplied by a discount factor of 0.859 based on 7 percent.

MSHA estimates that underground coal mine operators' annual cost to print, sign and post, or give to the part 90 miner, CPDM sampling data is \$1.4 million. Costs for each mine size are shown below:

Underground Coal Mine Operators

- \$118,271 for mines with 1-19 employees [24,200 samples per yr. x ((0.1667 hrs. x \$33.23 hourly wage) + \$0.15 copy costs) x 0.859];
- \$1,152,604 for mines with 20-500 employees [235,840 samples per yr. x ((0.1667 hrs. x \$33.23 hourly wage) + \$0.15 copy costs) x 0.859]; and

- \$148,963 for mines with 501+ employees [$30,480 \text{ samples per yr.} \times ((0.1667 \text{ hrs.} \times \$33.23 \text{ hourly wage}) + \$0.15 \text{ copy costs}) \times 0.859$].

Change in Status Report

Final §§ 70.212 and 90.210 require operators to submit to MSHA status change reports when there is a change in operational status of the mine, MMU, designated area (DA), or part 90 miner that affects respirable dust sampling requirements. This language is similar to existing §§ 70.220 and 90.220. Thus, there are no additional compliance costs for these requirements.

Cost Estimate for Training Miners Expected to Use a CPDM

Final §§ 70.201(h) and 90.201(h) require that training be provided to all miners expected to wear a CPDM. The training shall be completed prior to a miner being required to wear a CPDM and repeated every 12 months thereafter. The training includes: 1) the importance of monitoring dust concentrations and properly wearing the CPDM; 2) explaining the basic features and capabilities of the CPDM; 3) discussing the various types of information displayed by the CPDM and how to access that information; and 4) how to start and stop a short-term sample run during compliance sampling. Based on MSHA experience, the Agency estimates that the training will take 30 minutes (0.5 hours).

For an MMU, on every shift, each miner in an occupation sampled with a CPDM will need to receive CPDM training. However, to account for occasions when a miner is sick or leaves the job, MSHA estimates that two extra persons will be trained per occupation. Thus, MSHA estimates that each occupation per MMU, per shift, will have three miners that receive CPDM training. Therefore, the number of persons that MSHA estimates to receive annual CPDM training for an MMU, for each shift, is:

- 6 persons for a non-longwall MMU in a mine that uses exhaust face ventilation [$(1 \text{ DO} + 1 \text{ RB-ODO}) \times 3 \text{ persons}$];
- 12 persons for a non-longwall MMU in a mine that uses blowing face ventilation [$(1 \text{ DO} + 1 \text{ RB-ODO} + 2 \text{ SC-ODOs}) \times 3 \text{ persons}$];
- 9 persons for a longwall MMU [$(1 \text{ DO} + 1 \text{ Mechanic} + 1 \text{ Jack Setter}) \times 3 \text{ persons}$]; and
- 3 persons for the one additional shuttle car occupation for an MMU in a mine that is part of a super section [$(1 \text{ additional SC-ODO}) \times 3 \text{ persons}$].

MSHA's estimate of the number of MMUs shown below is taken from Table IV-30 that derived the annual costs for CPDM filters.

- In mines with 1-19 employees there are: 41 MMUs in mines using exhaust face ventilation, and 40 MMUs in mines using blowing face ventilation.
- In mines with 20-500 employees there are: 343 MMUs in mines using exhaust face ventilation; 343 MMUs in mines using blowing face ventilation; 22 longwall MMUs; and 225 MMUs that are part of a super section (included in the other MMU counts).
- In mines with 501+ employees there are: 36 MMUs in mines using exhaust face ventilation; 36 MMUs in mines using blowing face ventilation; 20 Longwall MMUs;

and 25 MMUs in mines that are part of a super section (included in other MMU counts).

In Table IV-31 below MSHA estimates that the annual cost to operators for CPDM training is \$307,000, of which \$13,400 is for mines with 1-19 employees; \$260,200 is for mines with 20-500 employees; and \$33,400 is for mines with 501+ employees.

Table IV-31: Annual Cost Estimates for Miners to Receive CPDM Training

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
Type of Mining and Ventilation Used in Mine	No. of Persons to Receive CPDM Training per MMU per Shift	No. of MMUs	No. of MMUs in Super Sections	No. of Shifts MMU Runs per Day	No. of Miners to Train Using CPDMs	Time to Train Miner in hrs.	Miner Hourly Wage Rate	Annual Costs for Miners CPDM Training ^a
Mines with 1-19 Employees								
Non-LW MMUs Using Exhaust Face Ventilation	6	41		1	246			
Non-LW MMUs Using Blowing Face Ventilation	12	40		1	480			
1-19 Total		81			726	0.5	\$36.92	\$13,402
Mines with 20-500 Employees								
Non-LW MMUs Using Exhaust Face Ventilation	6	343		2	4,116			
Non-LW MMUs Using Blowing Face Ventilation	12	343		2	8,232			
LW-MMUs	9	22		2	396			
Additional Person to Train at MMUs that are Part of Super Sections ^b	3		225	2	1,350			
20-500 Total		708			14,094	0.5	\$36.92	\$260,175
Mines with 501+ Employees								
Non-LW MMUs Using Exhaust Face Ventilation	6	36		2	432			
Non-LW MMUs Using Blowing Face Ventilation	12	36		2	864			
LW-MMUs	9	20		2	360			
Additional Person to Train at MMUs that are Part of Super Sections ^b	3		25	2	150			
501+ Total		92			1,806	0.5	\$36.92	\$33,339
Total		881	250		16,626			\$306,916

^a Col. i = col. f x col. g x col. h.

^b The 250 MMUs in Super Sections in column d is included in the 881 MMUs in column c.

In addition, 47 part 90 miners in mines with 20-500 employees and 19 part 90 miners in mines with 501+ employees will need to be trained. MSHA estimates that annual costs to train part 90 miners to use CPDMs are \$1,225. Costs by mine size are shown below.

Underground Coal Mine Operators

- \$868 in mines with 20-500 employees (47 part 90 miners x 0.5 hrs. x \$36.92 hourly wage rate); and
- \$351 in mines with 501+ employees (19 part 90 miners x 0.5 hrs. x \$36.92 hourly wage rate).

Also, MSHA estimates that a person certified in sampling with a CPDM, earning \$33.23 per hour in an underground coal mine, will spend 30 minutes (0.5 hours) providing one CPDM training session for miners on an MMU on each shift. MSHA assumes that part 90 miners are included in this training.

In Table IV-32 below MSHA estimates that the annual cost for persons certified in sampling to provide CPDM training is \$36,200, of which \$1,300 is for mines with 1-19 employees; \$31,000 is for mines with 20-500 employees; and \$3,900 is for mines with 501+ employees.

Table IV-32: Annual Cost Estimates for Trainers Who Provide CPDM Training

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
Type of Mining and Ventilation Used in Mine	No. of MMUs	No. of MMUs in Super Sections	No. of Shifts MMU Runs per Day	No. of Times Training is Provided	Time to Give Training in hrs.	Hourly Wage Rate	Annual Costs to Provide CPDM Training ^a
Mines with 1-19 Employees							
Non-LW MMUs Using Exhaust Face Ventilation	41		1	41			
Non-LW MMUs Using Blowing Face Ventilation	40		1	40			
1-19 Total	81			81	0.5	\$33.23	\$1,346
Mines with 20-500 Employees							
Non-LW MMUs Using Exhaust Face Ventilation	343		2	686			
Non-LW MMUs Using Blowing Face Ventilation	343		2	686			
LW-MMUs	22		2	44			
Additional Person to Train at MMUs that are Part of Super Sections ^b		225	2	450			
20-500 Total	708			1,866	0.5	\$33.23	\$31,004
Mines with 501+ Employees							
Non-LW MMUs Using Exhaust Face Ventilation	36		2	72			
Non-LW MMUs Using Blowing Face Ventilation	36		2	72			
LW-MMUs	20		2	40			
Additional Person to Train at MMUs that are Part of Super Sections ^b		25	2	50			
501+ Total	92			234	0.5	\$33.23	\$3,888
Total	881	250		2,181			\$36,238

^a Col. h = col. e x col. f x col. g.

^b The 250 MMUs in Super Sections in column c is included in the 881 MMUs in column b.

Cost Estimates to Record CPDM Training

Final §§ 70.201(i) and 90.201(i) require operators to keep a record of CPDM training. MSHA estimates 16,626 miners at underground coal mines will receive CPDM training, of which: 726 miners are in mines with 1-19 employees; 14,094 miners are in mines with 20-500 employees; and 1,806 miners are in mines with 501+ employees. In addition, there are 47 part 90 miners in mines with 20-500 employees and 19 part 90 miners in mines with 501+ employees that will need annual training. The total number of miners that will receive CPDM training is: 16,692: 726 miners are in mines with 1-19 employees; 14,141 are in mines with 20-500 employees; and 1,825 miners are in mines with 501+ employees.

MSHA estimates that it takes a clerical employee 30 seconds (0.0083 hours) to make a record of each miner who received CPDM training. MSHA estimates that the annual costs to make records for miners receiving CPDM training are \$3,975. Costs for each mine size are shown below:

Underground Coal Mine Operators:

- \$173 for mines with 1-19 employees (726 miners x 0.0083 hrs. x \$28.67 hourly wage

- rate);
- \$3,365 for mines with 20-500 employees (14,141 miners x 0.0083 hrs. x \$28.67 hourly wage rate); and
 - \$435 for mines with 501+ employees (1,825 miners x 0.0083 hrs. x \$28.67 hourly wage rate).

Summary of Cost Estimates for Underground Coal Mine Operators to Use CPDMs

Table IV-33 shows, by mine size, that MSHA's estimates of first year costs (costs that occur in the first year which do not repeat every year plus the annual costs) for using CPDMs to perform sampling are \$34.1 million.

**Table IV-33: Summary of Underground Coal Mine Operator's
First Year Cost Estimates for Using CPDMs at Underground Coal Mines^{a, b}**

Requirements	Std.	1-19	20-500	501+	Total
CPDM Related Equipment		\$198,700	\$637,100	\$18,000	\$853,800
Purchase CPDMs (includes Warranty Costs)	§§70.201(a), 70.208(a), & 90.201(a)	\$1,702,344	\$21,490,388	\$1,688,725	\$24,881,456
CPDM Filters		\$135,121	\$1,316,812	\$170,185	\$1,622,118
CPDM Annual Maint.		\$89,336	\$1,805,529	\$141,879	\$2,036,744
CPDM Before Shift Maint.		\$172,695	\$1,682,988	\$217,510	\$2,073,193
Validate/Certify/Transmit CPDM Data	§§ 70.210(f) & 90.210(f)	\$69,078	\$673,195	\$87,004	\$829,277
Sign & Post Dust Cards & Provide to Part 90 Miner	§§ 70.211I & 90.208(f)	\$118,271	\$1,152,604	\$148,963	\$1,419,838
CPDM Training & Records	§§70.201(h), (i) & 90.201(h), (i)	\$14,921	\$295,412	\$38,013	\$348,346
Total		\$2,500,466	\$29,054,028	\$2,510,279	\$34,064,772

^a Some totals in the table may not sum due to rounding.

^b First Year Costs include: costs that occur in the first year that do not repeat every year plus the annual costs. Some costs in this table change in various years and then obtain equilibrium. For these costs, the present value was taken each year for a 10-year period and then summed. The sum was then annualized over a 10-year period at a 7 percent discount rate.

Table IV-34 shows, by mine size, that MSHA's estimates of annualized costs (annualizing the costs that occur in the first year which do not repeat every year plus the annual costs) for using a CPDM to perform sampling are \$14.6 million.

**Table IV-34: Summary of Underground Coal Mine Operator's
Annualized Cost Estimates for Using CPDMs at Underground Coal Mines**

Requirements	Std.	1-19	20-500	501+	Total
CPDM Related Equipment		\$48,483	\$155,452	\$4,392	\$208,327
Purchase CPDMs (includes Warranty Costs)	§§70.201(a), 70.208(a), & 90.201(a)	\$415,372	\$5,243,655	\$412,049	\$6,071,076
CPDM Filters		\$135,121	\$1,316,812	\$170,185	\$1,622,118
CPDM Annual Maintenance		\$89,336	\$1,805,529	\$141,879	\$2,036,744
CPDM Before Shift Maint.		\$172,695	\$1,682,988	\$217,510	\$2,073,193
Validate/Certify/Transmit CPDM Data	§§ 70.210(f) & 90.210(f)	\$69,078	\$673,195	\$87,004	\$829,277
Sign & Post Dust Cards & Provide to Part 90 Miner	§§ 70.211(c) & 90.208(f)	\$118,271	\$1,152,604	\$148,963	\$1,419,838
CPDM Training & Records	§§70.201(h), (i) & 90.201(h), (i)	\$14,921	\$295,412	\$38,013	\$348,346
Total		\$1,063,277	\$12,325,647	\$1,219,995	\$14,608,919

On-Shift Examinations

Final § 75.362(a)(2) requires that the person conducting the examination to assure compliance with the respirable dust control parameters specified in the mine ventilation plan also record the results of the examination and corrective actions taken at the end of each shift for each MMU. This requirement impacts only the underground portion of underground coal mines.

MSHA estimates that a supervisor, earning \$84.69 per hour, takes 3 minutes (0.05 hours) to make a record of the examination for the average mine in all mine sizes. On average, MSHA estimates that: 81 MMUs in mines with 1-19 employees have 1 shift per day (or 81 shifts per day); 708 MMUs in mines with 20-500 employees have 2 shifts per day (or 1,416 shifts per day); and 92 MMUs in mines with 501+ employees have 2 shifts per day (or 184 shifts per day). Records of the examinations will need to be made of these shifts each work day. On average, MSHA estimates that the number of workdays per year is: 200 days for mines with 1-19 employees; 300 days for mines with 20-500 employees; and 350 days for mines with 501+ employees. MSHA estimates that the annual costs to record the results from on-shift examinations are \$2.1 million. Costs for each mine size are shown below:

Underground Coal Mine Operators:

- \$68,599 in mines with 1-19 employees (81 shifts per day x 200 days per yr. x 0.05 hrs. x \$84.69 hourly wage rate);
- \$1,798,816 in mines with 20-500 employees (1,416 shifts per day x 300 days per yr. x 0.05 hrs. x \$84.69 hourly wage rate); and

- \$272,702 in mines with 501+ employees (184 shifts per day x 350 days per yr. x 0.05 hrs. x \$84.69 hourly wage rate).

Final § 75.362(g)(2)(i) requires that the final § 75.362(a)(2) record be certified by initials, date and time on a board maintained at the section load-out or similar location showing that the examination was made prior to resuming production. This final standard does not add any new costs because the record is required under existing § 75.362(g)(2).

Final § 75.362(g)(2)(ii) requires that the final § 75.362(a)(2) record be verified, by initials and date, by the certified person directing the on-shift examination for compliance with the respirable dust control parameters specified in the mine ventilation plan. Verification shall be made no later than the end of the shift for which the examination was made. Final § 75.362(g)(3) requires that the mine foreman or equivalent official countersign each examination record under final paragraph (a)(2) after it is verified by the certified person in final paragraph (g)(2)(ii). MSHA estimates that it takes 1 minute (0.0167 hours) to verify the record by a certified person earning \$84.69 per hour; and another 1 minute (0.0167 hours) to review and countersign the record by a mine foreman or equivalent mine official earning \$84.69 per hour.

MSHA estimates that the number of records to be verified and countersigned per year is: 16,200 records in mines with 1-19 employees (81 shifts per day x 200 days per year); 424,800 records in mines with 20-500 employees (1,416 shifts per day x 300 days per year); and 64,400 records in mines with 501+ employees (184 shifts per day x 350 days per year). MSHA estimates that underground coal mine operators' annual costs to verify and countersign the final § 75.362(a)(2) record are \$1.4 million. Costs for each mine size are shown below:

Underground Coal Mine Operators:

- \$45,824 in mines with 1-19 employees [(16,200 records per yr. x 0.0167 hrs. x \$84.69 hourly wage rate) + (16,200 records per yr. x 0.0167 hrs. x \$84.69 hourly wage rate)];
- \$1,201,609 in mines with 20-500 employees [(424,800 records per yr. x 0.0167 hrs. x \$84.69 hourly wage rate) + (424,800 records per yr. x 0.0167 hrs. x \$84.69 hourly wage rate)]; and
- \$182,165 in mines with 501+ employees [(64,400 records per yr. x 0.0167 hrs. x \$84.69 hourly wage rate) + (64,400 records x 0.0167 hrs. x \$84.69 hourly wage rate)].

Table IV-35 shows, by mine size, that MSHA estimates of annual costs for underground coal mine operators to record, review, and countersign the on-shift examination records is \$3.6 million.

Table IV-35: Annual Cost Estimates for Underground Coal Mine Operators to Record Existing § 75.362 On-Shift Examinations, Verify and Countersign the Record

Requirements	1-19	20-500	501+	Total
Underground Coal Operators				
Record Exam	\$68,600	\$1,798,800	\$272,700	\$2,140,100
Verify & Countersign	\$45,800	\$1,201,600	\$182,200	\$1,429,600
Total	\$114,400	\$3,000,400	\$454,900	\$3,569,700

Periodic Examinations

Cost Estimates for Periodic Examinations

Final § 72.100(a) requires each coal mine operator to provide periodic examinations, including chest x-ray, spirometry, symptom assessment, and occupational history, at a frequency specified in this section and at no cost to each miner. Final § 72.100 also extends the periodic monitoring examinations requirement to miners at surface coal mines.

Final § 72.100(b) pertains to voluntary examinations and requires that each operator provide the opportunity to have the examinations specified in paragraph (a) at least every 5 years to all miners employed at a coal mine.

Final § 72.100(c) pertains to mandatory examinations. For a miner who begins work at a coal mine for the first time (i.e., the miner has not previously worked in any coal mine), the operator must provide the chest x-ray and spirometry examinations, symptom assessment, and occupational history at no cost to the miner no later than 30 days after beginning employment. The operator will provide follow-up examinations no later than 3 years after the initial examination if the miner is still employed at the same mine or at a mine owned by the same operator. If the follow-up chest x-ray or spirometry examination shows the miner has evidence of coal workers' pneumoconiosis or decreased lung function, and if the miner is still employed at the same mine or at a mine owned by the same operator, then the miner will be provided additional follow-up examinations no later than 2 years after the follow-up examination. For costing purposes, MSHA included the costs of these examinations in the costs developed for the examinations of the currently employed miners.

Under existing 42 CFR 37.3, operators must provide miners at underground coal mines and surface work areas of underground coal mines, the opportunity for chest x-rays at the frequencies noted above. For operators at underground coal mines, the only additional costs due to final § 72.100(a), (b), and (c) will be for the spirometry examination, symptom assessment, and occupational history. For operators of surface coal mines, the additional costs will be for the chest x-ray, spirometry exam, symptom assessment, and occupational history. MSHA estimates that a chest x-ray costs an average of \$100 and that a spirometry examination costs an average of \$35. These estimates include the costs for symptom assessment and occupational history.

Approximately 20 percent of miners at underground coal mines take the chest x-rays that are currently being offered. MSHA assumes that the same percentage of miners at underground coal mines will take the spirometry examination and that the same percentage of miners at surface coal mines will take both the chest x-ray and spirometry examinations. (This could be an overestimate. Since the rate of pneumoconiosis is lower for surface coal miners than for underground coal miners, it is likely that the percentage of surface coal miners who choose to take the examinations will be lower.) Since the voluntary examinations must be offered once every 5 years, MSHA estimates that on average 4 percent of currently employed miners will take the examinations every year (20 percent taking the examination every 5 years).

MSHA used turnover rates of 6 percent in underground coal and 3 percent in surface coal mines to estimate the number of new miners who will have to take the initial mandatory examinations. MSHA assumed that 20 percent of this group of miners will take the follow-up examinations. Since follow-up examinations are offered every 3 years, this represents an annual

average of 0.4 percent of miners in underground coal mines and 0.2 percent of miners in surface coal mines taking follow-up examinations.

MSHA estimates that each year 10.4 percent of miners in underground coal mines (4 percent representing current miners, 6 percent representing newly -hired miners and 0.4 percent representing newly -hired miners taking follow-up examinations) will take both examinations each year. MSHA estimates that each year 7.2 percent of miners in surface coal mines (4 percent representing current miners, 3 percent representing newly hired miners and 0.2 percent representing newly hired miners taking follow-up examinations) will take both examinations each year.

MSHA estimates that 4,888 employed miners (including contractor employees) in underground coal mines will take the spirometry examination each year: 230 in underground coal mines with 1-19 employees (2,214 current miners x 0.104); 3,581 in mines with 20-500 employees (34,430 current miners x 0.104); and 1,077 miners in mines with 501+ employees (10,360 current miners x 0.104). MSHA also estimates that 4,036 currently employed miners at surface coal mines will take the x-ray and spirometry examinations each year: 968 miners at mines with 1-19 employees (13,448 current miners x 0.072), 2,698 miners at mines with 20-500 employees (37,478 current miners x 0.072); and 370 miners at surface coal mines with 501+ employees (5,141 current miners x 0.072).

MSHA estimates that annual costs for operators to provide x-ray and spirometry examinations under final § 72.100(a), (b) and (c) are \$716,000, of which \$171,000 are for underground coal mine operators and \$545,000 are for surface coal mine operators. Costs for each mine size are shown below:

Underground Coal Mine Operators:

- \$8,050 for mines with 1-19 employees (230 miners x \$35 for spirometry examination);
- \$125,335 for mines with 20-500 employees (3,581 miners x \$35 for spirometry examination); and
- \$37,695 for mines with 501+ employees (1,077 miners x \$35 for spirometry examination).

Surface Coal Mine Operators:

- \$130,680 for mines with 1-19 employees (968 miners x (\$100 for chest x-ray + \$35 for spirometry examination));
- \$364,230 for mines with 20-500 employees (2,698 miners x (\$100 for chest x-ray + \$35 for spirometry examination)); and
- \$50,085 for mines with 501+ employees (371 miners x (\$100 for chest x-ray + \$35 for spirometry examination)).

Cost Estimates to Develop Roster and Plan for Providing Miners with Examinations and Post Plan

Final § 72.100(d) requires that each coal mine operator develop and submit to the National Institute for Occupational Safety and Health (NIOSH) a plan as specified in 42 CFR Part 37 for providing miners with the examinations specified in final § 72.100(a) and a roster

specifying the name and current address of each miner covered by the plan. Final § 72.100(e) requires operators to post the approved NIOSH plan on the mine bulletin board.

Under existing 42 CFR 37.4, each operator of an underground coal mine is required to submit to NIOSH a plan for providing miners with the required chest x-rays and to post it on the mine bulletin board. It has been a practice that operators submit to NIOSH an employee roster with the plan. MSHA assumes that, in the first year of the final rule, underground coal mine operators will revise the existing rosters and plans for chest x-rays to add spirometry testing. In an underground coal mine, MSHA estimates that it takes a supervisor, earning \$84.69 an hour, 10 minutes (0.167 hours) to revise the roster and plan and a clerical employee, earning \$28.67 an hour, 5 minutes (0.0833 hours) to copy and submit the revised roster and plan and post the plan. MSHA estimates that copy costs are \$0.30 per roster and plan (2 pgs. x \$0.15 per page).

Each surface coal mine operator will develop and submit to NIOSH a roster and plan for providing the examinations specified in final § 72.100(a). In a surface coal mine, MSHA estimates that it takes a supervisor earning \$71.18 per hour, 1 hour to develop the roster and plan and a clerical employee, earning \$23.91 an hour, 5 minutes (0.0833 hours) to copy and submit the roster and plan and post them. MSHA estimates that copy costs are \$0.30 per roster and plan (2 pgs. x \$0.15 per page).

MSHA estimates that first year costs under final § 72.100(d) and (e) are \$89,600, of which \$7,100 are for underground coal mine operators and \$82,500 are for surface coal mine operators. Costs for each mine size are shown below:

Underground Coal Mine Operators:

- \$1,363 for mines with 1-19 employees [81 revised plans x (((\$84.69 hourly wage x 0.167 hrs.) + (\$28.67 hourly wage x 0.0833 hrs.) + \$0.30 for copying)];
- \$5,571 for mines with 20-500 employees [331 revised plans x (((\$84.69 hourly wage x 0.167 hrs.) + (\$28.67 hourly wage x 0.0833 hrs.) + \$0.30 for copying)]; and
- \$202 for mines with 501+ employees [12 revised plans x (((\$84.69 hourly wage x 0.167 hrs.) + (\$28.67 hourly wage x 0.0833 hrs.) + \$0.30 for copying)].

Surface Coal Mine Operators:

- \$45,552 for mines with 1-19 employees [620 plans x (((\$71.18 hourly wage x 1 hr.) + (\$23.91 hourly wage x 0.0833 hrs.) + \$0.30 for copying)];
- \$36,662 for mines with 20-500 employees [499 plans x (((\$71.18 hourly wage x 1 hr.) + (\$23.91 hourly wage x 0.0833 hr.) + \$0.30 for copying)]; and
- \$294 for mines with 501+ employees [4 plans x (((\$71.18 hourly wage x 1 hr.) + (\$23.91 hourly wage x 0.0833 hrs.) + \$0.30 for copying)].

First year cost estimates were annualized over 10 years by multiplying them by a factor of 0.142 based on a 7 percent discount rate to arrive at an annualized cost estimate of \$12,700, of which \$1,000 is for underground coal mines and \$11,700 is for surface coal mines.

Cost Estimates to Revise Plan and Post Plan

MSHA estimates that the plan required under final § 72.100(d) must be provided to NIOSH at least once every 5 years and that each year one fifth of the mines will have to revise a plan to specify the 6 month period that the examinations will be available and the NIOSH-

approved facility that will provide the examinations. Final § 72.100(e) requires the operator to post the approved plan. MSHA estimates that it takes a supervisor, earning \$84.69 an hour in an underground coal mine or \$71.18 an hour in a surface coal mine, 10 minutes (0.167 hours) to revise the plan and a clerical employee, earning \$28.67 an hour in an underground coal mine or \$23.91 an hour in a surface coal mine, 5 minutes (0.0833 hours) to copy and submit the revised plan and post the plan. MSHA estimates that copy costs are \$0.30 per plan (2 pgs. x \$0.15 per page). MSHA estimates that annual costs for operators to revise, submit and post plans are \$4,600, of which \$1,400 is for underground coal mine operators and \$3,200 is for surface coal mine operators. Costs for each mine size are shown below:

Underground Coal Mine Operators:

- \$273 for mines with 1-19 employees [16 mines x ((\$84.69 hourly wage x 0.167 hrs.) + (\$28.67 hourly wage x 0.0833 hrs.) + \$.30 for copying)];
- \$1,114 for mines with 20-500 employees [66 mines x ((\$84.69 hourly wage x 0.167 hrs.) + (\$28.67 hourly wage x 0.0833 hrs.) + \$.30 for copying)]; and
- \$40 for mines with 501+ employees [2 mines x ((\$84.69 hourly wage x 0.167 hrs.) + (\$28.67 hourly wage x 0.0833 hrs.) + \$.30 for copying)].

Surface Coal Mine Operators:

- \$1,758 for mines with 1-19 employees [124 mines x ((\$71.18 hourly wage x 0.167 hrs.) + (\$23.91 hourly wage x 0.0833 hrs.) + \$.30 for copying)];
- \$1,415 for mines with 20-500 employees [100 mines x ((\$71.18 hourly wage x 0.167 hrs.) + (\$23.91 hourly wage x 0.0833 hrs.) + \$.30 for copying)]; and
- \$11 for mines with 501+ employees [1 mine x ((\$71.18 hourly wage x 0.167 hrs.) + (\$23.91 hourly wage x 0.0833 hrs.) + \$.30 for copying)].

Table IV-36 shows, by mine size, first year costs (costs that occur in the first year which do not repeat every year plus the annual costs) related to x-ray and spirometry examinations. Total first year costs are approximately \$179,700 for underground coal mine operators and \$630,800 for surface coal mine operators.

Table IV-36: First Year Cost Estimates for Periodic Examinations

Requirement	1-19	20-500	501+	Total
Underground Coal Operators				
Periodic Examinations	\$8,100	\$125,300	\$37,700	\$171,100
Develop Plans	\$1,400	\$5,600	\$200	\$7,200
Revise Plans	\$270	\$1,110	\$40	\$1,400
Total	\$9,770	\$132,010	\$37,940	\$179,700
Surface Coal Operators				
Periodic Examinations	\$130,700	\$364,200	\$50,100	\$545,000
Develop Plans	\$45,600	\$36,700	\$300	\$82,600
Revise Plans	\$1,760	\$1,420	\$10	\$3,200
Total	\$178,060	\$402,320	\$50,410	\$630,800

First Year Costs = costs that occur in the first year which do not repeat every year plus the ongoing costs.

Table IV-37 shows, by mine size, annualized cost estimates related to x-ray and spirometry examinations. Total annualized costs are approximately \$173,500 for underground coal mine operators and \$559,900 for surface coal mine operators.

Table IV-37: Annualized Cost Estimates for Periodic Examinations

Requirement	1-19	20-500	501+	Total
Underground Coal Operators				
Periodic Examinations	\$8,100	\$125,300	\$37,700	\$171,100
Develop Plans	\$190	\$790	\$30	\$1,010
Revise Plans	\$270	\$1,110	\$40	\$1,420
Total	\$8,560	\$127,200	\$37,770	\$173,530
Surface Coal Operators				
Periodic Examinations	\$130,700	\$364,200	\$50,100	\$545,000
Develop Plans	\$6,500	\$5,200	\$40	\$11,740
Revise Plans	\$1,760	\$1,420	\$10	\$3,190
Total	\$138,960	\$370,820	\$50,150	\$559,930

Annualized Costs = annualizing over ten years the costs that occur in the first year which do not repeat every year plus ongoing costs.

Respiratory Equipment; Respirable Dust

Respiratory Equipment

Final § 72.700(a) requires operators to maintain an adequate supply of respiratory equipment. The final rule expands the existing standard's scope of coverage to include miners at surface coal mines and part 90 miners.

Existing § 70.300 requires underground coal mine operators to maintain a supply of respiratory equipment adequate to deal with occurrences of concentrations of respirable dust in the mine atmosphere in excess of the applicable standard. Therefore, there are no additional costs for underground coal mine operators.

MSHA expects that surface coal mine operators have an adequate supply of respirators and do not need to purchase additional ones as a result of the final rule. Some operators of surface coal mines also operate underground coal mines where there is a history of respirator use. These operators routinely provide respirators at both their underground and surface coal mines. In addition, surface coal mine operators consider it a good work practice to provide respirators to miners when necessary. Having respirators on hand to provide to miners is viewed by operators as part of a comprehensive plan that increases the protection of miners against job-related health hazards while at the same time minimizing operators' workers' compensation cost premiums from health insurance providers. Therefore, MSHA assumes that there are also no additional costs for surface coal mine operators to purchase respirators.

Cost Estimates for Respirator Training

Final § 72.700(b) requires coal mine operators to provide training on the care, fit, use and limitations of each type of respirator to miners who have respirators made available to them

under final § 72.700(a) unless the miner received training on the types of available respirators within the previous 12 months. MSHA has determined that four groups of miners will be offered respiratory protection - miners at MMUs, miners at DAs, miners at DWPs on the surface, and part 90 miners.

MSHA estimates that respirator training takes 15 minutes (0.25 hours) and is given by a supervisor, earning \$84.69 an hour in an underground coal mine or \$71.18 an hour in a surface coal mine. The miner's hourly wage rate is \$36.92 in underground coal mines and \$31.26 in surface coal mines.

For underground coal miners at MMUs and DAs, and part 90 miners, final §§ 70.206(e)(1), 70.207(d)(1), 70.208(e)(1), 70.209(c)(1), and 90.207(c)(1) require that respiratory protection be made available when a respirable dust sample meets or exceeds the ECV. In addition, respiratory protection must be made available upon issuance of a citation for violation of the applicable standard under final §§ 70.206(h)(1), 70.207(g)(1), 70.208(h)(1), 70.209(f)(1), and 90.207(f)(1).

To reduce the possibility of disrupting production because a trainer is not available to provide respiratory protection training, MSHA expects that underground coal mine operators will provide respiratory protection training each year during regularly scheduled training sessions rather than wait to train the miners after a sample exceeds the applicable standard. MSHA assumes that the training will be conducted in groups so that all underground coal miners at the same MMU on the same shift receive training at the same time, including part 90 miners and miners working at DAs. In the calculations below, the number of training sessions equals the number of shifts that were determined earlier when deriving the compliance costs for recording shift production.

There are typically 6 miners working at each MMU per shift. Since respiratory protection is also required to be made available to part 90 miners and miners working at DAs, MSHA added 0.1, approximately a 10 percent increase, to the number of miners at each training session to account for training part 90 miners and miners at DAs (i.e., number of training sessions multiplied by 6.1 miners per session). Therefore, MSHA estimates that the number of underground coal miners to train is: 494 trainees in mines with 1-19 employees (81 sessions x 6.1 trainees per session); 8,638 trainees in mines with 20-500 employees (1,416 sessions x 6.1 trainees per session); and 1,122 trainees in mines with 501+ employees (184 sessions x 6.1 trainees).

For surface coal miners, including part 90 miners, respiratory protection is required to be made available under final §§ 71.206(h)(1) and 90.207(c)(1) when a respirable dust sample meets or exceeds the ECV, and under final §§ 71.206(k)(1) and 90.207(f)(1) upon issuance of a citation for violation of the applicable standard. MSHA assumes that respirable dust samples that meet or exceed the ECV will result in a citation. Thus, the number of surface coal miners needing training due to a violation of the standard equals the number of citations. The number of miners to be trained in surface coal mines varies according to the estimated number of citations, which will be different for the first few years that the final rule is in effect. MSHA expects the number of citations to increase in the third year due to the reduction in the respirable coal mine dust standard to 1.5 mg/m³ and to remain constant for the 5th year and each year thereafter.

MSHA estimates that annual costs for underground coal mine operators to provide respirator training under final § 72.700(b) are \$130,000.

Underground Coal Mine Operators:

- \$6,275 for mines with 1-19 employees [(494 trainees x \$36.92 hourly wage rate x 0.25 hrs. for training) + (81 sessions x \$84.69 trainer's hourly wage rate x 0.25 hrs. of instructor time)];
- \$109,709 for mines with 20-500 employees [(8,638 trainees x \$36.92 hourly wage rate x 0.25 hrs. for training) + (1,416 sessions x \$84.69 trainer's hourly wage rate x 0.25 hrs. of instructor time)]; and
- \$14,252 for mines with 501+ employees [(1,122 trainees x \$36.92 hourly wage rate x 0.25 hrs. for training) + (184 sessions x \$84.69 trainer's hourly wage rate x 0.25 hrs. of instructor time)].

MSHA estimates that the costs for surface coal mine operators to provide respirator training under final § 72.700(b) are: \$2,400 in the first year; \$1,450 in the second year; \$1,850 in the third year; \$1,100 in the fourth year; and \$850 in the fifth year and each year thereafter that the final rule is in effect.

Surface Coal Mine Operators - First Year

- \$1,204 for mines with 1-19 employees [47 trainees x ((\$31.26 hourly wage rate x 0.25 hrs. for training) + (\$71.18 trainer's hourly wage rate x 0.25 hrs. for instructors' time))];
- \$948 for mines with 20-500 employees [37 trainees x ((\$31.26 hourly wage rate x 0.25 hrs. for training) + (\$71.18 trainer's hourly wage rate x 0.25 hrs. for instructors' time))]; and
- \$230 for mines with 501+ employees [9 trainees x ((\$31.26 hourly wage rate x 0.25 hrs. for training) + (\$71.18 trainer's hourly wage rate x 0.25 hrs. for instructors' time))].

Surface Coal Mine Operators - Second Year:

- \$743 for mines with 1-19 employees [29 trainees x ((\$31.26 hourly wage rate x 0.25 hrs. for training) + (\$71.18 trainer's hourly wage rate x 0.25 hrs. for instructors' time))];
- \$589 for mines with 20-500 employees [23 trainees x ((\$31.26 hourly wage rate x 0.25 hrs. for training) + (\$71.18 trainer's hourly wage rate x 0.25 hrs. for instructors' time))]; and
- \$128 for mines with 501+ employees [5 trainees x ((\$31.26 hourly wage rate x 0.25 hrs. for training) + (\$71.18 trainer's hourly wage rate x 0.25 hrs. for instructors' time))].

Surface Coal Mine Operators - Third Year:

- \$948 for mines with 1-19 employees [37 trainees x ((\$31.26 hourly wage rate x 0.25 hrs. for training) + (\$71.18 trainer's hourly wage rate x 0.25 hrs. for instructors' time))];
- \$743 for mines with 20-500 employees [29 trainees x ((\$31.26 hourly wage rate x 0.25 hrs. for training) + (\$71.18 trainer's hourly wage rate x 0.25 hrs. for instructors' time))]; and

- \$179 for mines with 501+ employees [7 trainees x (($\$31.26 \text{ hourly wage rate} \times 0.25 \text{ hrs. for training}$) + ($\$71.18 \text{ trainer's hourly wage rate} \times 0.25 \text{ hrs. for instructors' time}$))].

Surface Coal Mine Operators - Fourth Year:

- \$563 for mines with 1-19 employees [22 trainees x (($\$31.26 \text{ hourly wage rate} \times 0.25 \text{ hrs. for training}$) + ($\$71.18 \text{ trainer's hourly wage rate} \times 0.25 \text{ hrs. for instructors' time}$))];
- \$435 for mines with 20-500 employees [17 trainees x (($\$31.26 \text{ hourly wage rate} \times 0.25 \text{ hrs. for training}$) + ($\$71.18 \text{ trainer's hourly wage rate} \times 0.25 \text{ hrs. for instructors' time}$))]; and
- \$102 for mines with 501+ employees [4 trainees x (($\$31.26 \text{ hourly wage rate} \times 0.25 \text{ hrs. for training}$) + ($\$71.18 \text{ trainer's hourly wage rate} \times 0.25 \text{ hrs. for instructors' time}$))].

Surface Coal Mine Operators - Fifth Year and Every Year Thereafter:

- \$435 for mines with 1-19 employees [17 trainees x (($\$31.26 \text{ hourly wage rate} \times 0.25 \text{ hrs. for training}$) + ($\$71.18 \text{ trainer's hourly wage rate} \times 0.25 \text{ hrs. for instructors' time}$))];
- \$359 for mines with 20-500 employees [14 trainees x (($\$31.26 \text{ hourly wage rate} \times 0.25 \text{ hrs. for training}$) + ($\$71.18 \text{ trainer's hourly wage rate} \times 0.25 \text{ hrs. for instructors' time}$))]; and
- \$77 for mines with 501+ employees [3 trainees x (($\$31.26 \text{ hourly wage rate} \times 0.25 \text{ hrs. for training}$) + ($\$71.18 \text{ trainer's hourly wage rate} \times 0.25 \text{ hrs. for instructors' time}$))].

As noted above, under the final rule, the cost to provide respirator training in surface coal mines changes each year until the fifth year, after which it remains constant. The Agency estimated costs that will be incurred over a 10-year period by multiplying each year's costs (excluding the costs in the first year) by a discount factor. MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at annual cost estimates of: \$693 for mines with 1-19 employees; \$553 for mines with 20-500 employees; and \$126 for mines with 501+ employees.

Cost Estimates to Make a Record of Respirator Training

Final § 72.700(c) requires operators to keep a record of respirator training for two years after completion of the respirator training. This record may be kept elsewhere if the record is immediately available at the mine site by electronic transmission. MSHA estimates that it takes a clerical employee, earning \$28.67 an hour in an underground coal mine or \$23.91 an hour in a surface coal mine, 30 seconds (0.00833 hours) per trainee to make a record of respirator training.

MSHA estimates that annual costs for underground coal mine operators to make a record of respirator training are \$2,450.

Underground Coal Mine Operators

- \$118 for mines with 1-19 employees (494 trainee records x $\$28.67 \text{ hourly wage rate} \times 0.00833 \text{ hrs. for clerical labor}$);

- \$2,064 for mines with 20-500 employees (8,638 trainee records x \$28.67 hourly wage rate x 0.00833 hrs. for clerical labor); and
- \$268 for mines with 501+ employees ((1,122 trainee records x \$28.67 hourly wage rate x 0.00833 hrs. for clerical labor).

MSHA estimates that the costs for surface coal mine operators to make a record of respiratory training are : \$18 in the first year; \$12 in the second year; \$14 in the third year; and \$8 in the fourth year, \$7 in the fifth year and each year thereafter, that the final rule is in effect. Costs for each mine size are shown below:

Surface Coal Mine Operators - First Year

- \$9 for mines with 1-19 employees (47 trainee records x \$23.91 hourly wage rate x 0.00833 hrs. for clerical labor);
- \$7 for mines with 20-500 employees (37 trainee records x \$23.91 hourly wage rate x 0.00833 hrs. for clerical labor); and
- \$2 for mines with 501+ employees (9 trainee records x \$23.91 hourly wage rate x 0.00833 hrs. for clerical labor).

Surface Coal Mine Operators - Second Year

- \$6 for mines with 1-19 employees (29 trainee records x \$23.91 hourly wage rate x 0.00833 hrs. for clerical labor);
- \$5 for mines with 20-500 employees (23 trainee records x \$23.91 hourly wage rate x 0.00833 hrs. for clerical labor); and
- \$1 for mines with 501+ employees (5 trainee records x \$23.91 hourly wage rate x 0.00833 hrs. for clerical labor).

Surface Coal Mine Operators - Third Year

- \$7 for mines with 1-19 employees (37 trainee records x \$23.91 hourly wage rate x 0.00833 hrs. for clerical labor);
- \$6 for mines with 20-500 employees (29 trainee records x \$23.91 hourly wage rate x 0.00833 hrs. for clerical labor); and
- \$1 for mines with 501+ employees (7 trainee records x \$23.91 hourly wage rate x 0.00833 hrs. for clerical labor).

Surface Coal Mine Operators – Fourth Year

- \$4 for mines with 1-19 employees (22 trainee records x \$23.91 hourly wage rate x 0.00833 hrs. for clerical labor);
- \$3 for mines with 20-500 employees (17 trainee records x \$23.91 hourly wage rate x 0.00833 hrs. for clerical labor); and
- \$1 for mines with 501+ employees (4 trainee records x \$23.91 hourly wage rate x 0.00833 hrs. for clerical labor).

Surface Coal Mine Operators – Fifth Year and Every Year Thereafter

- \$3 for mines with 1-19 employees (17 trainee records x \$23.91 hourly wage rate x 0.00833 hrs. for clerical labor);

- \$3 for mines with 20-500 employees (14 trainee records x \$23.91 hourly wage rate x 0.00833 hrs. for clerical labor); and
- \$1 for mines with 501+ employees (3 trainee records x \$23.91 hourly wage rate x 0.00833 hrs. for clerical labor).

Under the final rule, the cost to make a record of respiratory training in surface coal mines changes each year until the fifth year, after which it remains constant. The Agency estimated costs that will be incurred over a 10-year period by multiplying each year's costs (excluding the costs in the first year) by a discount factor. MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at annual cost estimates of: \$5 for mines with 1-19 employees; \$4 for mines with 20-500 employees; and \$1 for mines with 501+ employees.

Table IV-38 shows that MSHA's estimates of annual costs for respiratory training and recordkeeping are \$132,700 for underground coal mine operators and \$1,400 for surface coal mine operators.

Table IV-38: Annual Cost Estimates for Respiratory Training

Requirement	1-19	20-500	501+	Total
Underground Coal Operators				
Respiratory Training	\$6,270	\$109,710	\$14,250	\$130,230
Recordkeeping	\$120	\$2,060	\$270	\$2,450
Total	\$6,390	\$111,770	\$14,520	\$132,680
Surface Coal Operators				
Respiratory Training	\$690	\$550	\$130	\$1,370
Recordkeeping	\$10	\$10	\$10	\$30
Total	\$700	\$560	\$140	\$1,400

Extension of Part 90 Option to Miners at Surface Coal Mines

CPDM Cost Estimates for Part 90 Miners at Surface Coal Mines

Under final § 90.201(a) 18 months after the effective date of the final rule, part 90 miners must be sampled using a CPDM. This applies to all part 90 miners, including those at surface coal mines.

Part 90 Scope

Final § 90.1 extends the scope of the part 90 miner option to include miners employed at surface coal mines. Existing § 90.1 limits the scope of part 90 to miners employed at underground coal mines or at surface areas of underground coal mines.

Under the final rule, miners who exercise their part 90 miner option must be afforded the option to work in an area of a mine where the average concentration of respirable dust in the mine atmosphere during each shift to which that miner is exposed is continuously maintained at or below the applicable standard. Under final § 90.100, the standard for part 90 miners is 1.0

mg/m³ when the rule goes into effect; the standard will be lowered to 0.5 mg/m³ 24 months after the effective date of the final rule. Based on historical monitoring data collected from surface coal mines presented in Section III.C.3.a. of the preamble to the final rule, MSHA has determined that there are numerous areas at surface coal mines that meet these standards. Therefore, the costs associated with transferring miners who exercise the part 90 miner option should be de minimis.

Final § 90.201(a) requires that operators sample the concentration of respirable coal mine dust in the working environment of each part 90 miner. During the 18-month period after the rule is in effect, operators can use the gravimetric sampling device to sample part 90 miners. Eighteen months after the effective date of the rule, operators are required to sample part 90 miners using CPDMs. To exercise the part 90 miner option, miners must have evidence of the development of pneumoconiosis. Under final § 72.100, operators will be required to provide miners with the option to have medical surveillance examinations once every five years. Since surface coal mine operators are not currently required to provide this testing, MSHA assumes that no new miners will exercise the part 90 option at surface mines for the first 18 months that the final rule is in effect (i.e., while the NIOSH medical surveillance plans are developed, the miners are tested, the results are reviewed, etc.). Therefore, MSHA has not estimated any costs related to sampling part 90 miners in the first 18 months that the final rule is in effect. MSHA assumes that any miners at surface coal mines who are eligible for the part 90 option will exercise it 18 months after the final rule is in effect, when operators are required to sample part 90 miners with the CPDM. The cost estimates below for sampling part 90 miners at surface coal mines begin 18 months after the final rule is in effect.

Finally, MSHA assumes that no surface coal miner who begins work at a coal mine for the first time will have evidence of pneumoconiosis, which is a prerequisite to exercise the part 90 miner option. MSHA believes that the cost estimate of surface coal miners exercising the part 90 miner option probably overstates the cost because many surface coal mine operators may not offer to provide testing for their existing workforce until the fourth year after the effective date of the final rule.

MSHA assumes that surface coal mine operators will purchase their own CPDMs and conduct their own part 90 miner sampling. However, it may be more cost-effective for mines to contract for CPDM sampling of part 90 miners. If this were done, the costs derived below for part 90 miner sampling in surface coal mines are overstated. However, since the market for and pricing for a contractor to perform part 90 miner sampling with the CPDMs has not been established, MSHA's estimate assumes that operators are taking samples with operator-owned CPDMs.

Miners at Surface Coal Mines Who Could Exercise the Part 90 Miner Option

Since MSHA has no experience with part 90 miners at surface coal mines, there are no specific historical data on which to estimate the number of miners at surface coal mines who could exercise their part 90 miner option.

According to historical data from NIOSH's miner x-ray programs (e.g., Miners' Choice and the Coal Workers' X-ray Surveillance Program), 1,264 of the 32,250 surface coal miners examined (approximately 3.9 percent) showed evidence of pneumoconiosis. However, based on MSHA's experience with miners at underground coal mines, MSHA does not expect all surface coal miners who have evidence of pneumoconiosis to exercise the part 90 miner option. As of

2009, there were only 66 part 90 miners. NIOSH data indicate that 19,148 of the 224,131 miners (approximately 8.5 percent) at underground coal mines examined showed evidence of pneumoconiosis. Based on this percentage, MSHA estimates that approximately 8.5 percent, or 3,427 miners of 40,319 underground coal miners, excluding contractors, (see Table II-1), are eligible for the part 90 miner option. MSHA's experience is that most underground coal miners who qualify for the option do not exercise it. However, to account for the likelihood that surface coal miners could exercise the part 90 miner option at greater rates than do underground coal miners (e.g., underground coal miners exercised the part 90 miner option at greater rates when the option was first made available), MSHA assumes 200 surface coal miners (approximately three times the number of part 90 miners currently in underground coal mines) will exercise the part 90 miner option.

The following compliance costs are based on the estimate that 200 surface coal miners will exercise the part 90 miner option. This is the same estimate that was used in the PREA. Although there were comments on the effectiveness of the existing part 90 miner program and proposed revisions to that program, there were no comments concerning the number of surface coal miners that MSHA used to estimate part 90 compliance costs in the PREA. Therefore, for this analysis, MSHA retains its estimate made in the PREA. Changes in the cost of items used to derive the part 90 costs to surface coal miner operators (such as changing the price of CPDMs or the price of filters) are noted below.

Certify Persons in the Use, Maintenance and Calibration of Sampling Equipment at Surface Coal Mines

Certify Persons to Perform Sampling and Maintenance and Calibration

Final § 90.202(b) retains the existing requirement that candidates for certification in sampling pass an MSHA examination to demonstrate competency in respirable dust sampling procedures. To assure consistent administration of the certification process, however, the provision adds a requirement that candidates for certification complete an MSHA course of instruction prior to certification. Final § 90.203(b) also retains the existing requirement that candidates for certification for maintenance and calibration of approved sampling devices pass an MSHA examination to demonstrate competency in the maintenance and calibration procedures. Final § 90.203(b) also includes a requirement that candidates for certification complete an MSHA course of instruction to maintain and calibrate approved sampling devices prior to certification. MSHA will provide both sampling and maintenance and calibration courses at no charge; however, MSHA assumes that persons will have to travel to either an MSHA district or field office to take the courses.

MSHA previously derived the costs related to surface coal mines certifying persons to perform sampling using the gravimetric sampler. Below, costs are derived related to certifying persons to perform sampling with the CPDM. Based on the worst-case assumption that all 200 part 90 miners (estimated in the preceding section) will be employed at different mines, MSHA estimates that 400 persons will have to be certified on the CPDM (2 persons per part 90 miner). MSHA has assumed certifications for two persons for each part 90 miner to account for occasions on sampling days when a certified person may be absent due to illness. MSHA assumes that these 400 persons will be certified to both sample with and maintain and calibrate the CPDM. In addition, as noted previously, MSHA assumes that persons will be certified

during the first year that the final rule is in effect, even though sampling with the CPDM is not required until 18 months after the effective date of the final rule.

MSHA estimates that it takes a person 9 hours for the CPDM course and examination on sampling (7 hours for the course, 1 hour for the examination and 1 hour to travel to and from the course site) and 9 hours for the CPDM course and examination on maintenance and calibration (7 hours for the course, 1 hour for the examination and 1 hour to travel to and from the course site). Thus, a total of 18 hours is needed. MSHA estimates that a person certified for sampling earns \$28.13 per hour in a surface coal mine. MSHA also expects that each person will require \$100 in travel expenses for 2 days of travel (\$50 in travel expense for one day to take the course concerning sampling and an additional \$50 in travel expenses for another day to take the maintenance and calibration course).

Surface Coal Mine Operators

MSHA estimates that the first year costs to certify persons are \$242,500. Costs for each mine size are shown below:

- \$36,380 in mines with 1-19 employees [(60 persons to be certified x (18 hrs. x \$28.13 hourly wage rate) + \$100 travel expense)];
- \$179,477 in mines with 20-500 employees [(296 persons to be certified x (18 hrs. x \$28.13 hourly wage rate) + \$100 travel expense)]; and
- \$26,679 in mines with 501+ employees [(44 persons to be certified x (18 hrs. x \$28.13 hourly wage rate) + \$100 travel expense)].

The first year cost estimates were annualized over 10 years by applying a factor of 0.142 based on a 7 percent discount rate to arrive at annualized cost estimate of \$17,500.

Turnover Cost Estimates Related to Certifying Persons

Some certified persons may leave their jobs and have to be replaced. MSHA estimates an annual turnover rate of 3 percent, resulting in an additional 12 persons (400 x 0.03) who will need to be certified each year (including the first year). Of the 12 persons: 2 persons are in a mine with 1-19 employees; 9 persons are in mines with 20-500 employees; and 1 person is in a mine with 501+ employees. Turnover costs are incurred annually, including in the first year that the final rule is in effect.

Surface Coal Mine Operators

MSHA estimates that annual costs to certify persons are \$7,300. Costs for each mine size are shown below:

- \$1,213 in mines with 1-19 employees [(2 persons to be certified x (18 hrs. x \$28.13 hourly wage rate) + \$100 travel expense)];
- \$5,457 in mines with 20-500 employees [(9 persons to be certified x (18 hrs. x \$28.13 hourly wage rate) + \$100 travel expense)]; and
- \$606 in mines with 501+ employees [(1 person to be certified x (18 hrs. x \$28.13 hourly wage rate) + \$100 travel expense)].

Cost Estimates for Persons to Take Examinations to Maintain Certification

Final §§ 90.202(c) and 90.203(c) require certified persons to pass the MSHA

examinations demonstrating competency in sampling procedures or maintenance and calibration procedures every three years to maintain their certifications. Persons that fail the examination must retake the examination to become recertified.

MSHA made the simplifying assumption that one-third of the certified persons will take the re-certification examination each year. MSHA estimates that 133 persons (400×0.3333) will take the examination each year. MSHA adjusted this figure by 10 percent to account for some persons failing and retaking the examination. Therefore, MSHA estimates that 146 persons ($133 \text{ persons} \times 1.1$) will take the examination each year, of which: 22 persons are in mines with 1-19 employees; 108 persons are in mines with 20-500 employees; and 16 persons are in mines with 501+ employees. MSHA estimates that it takes 1 hour for the CPDM examination on sampling, 1 hour for CPDM examination on maintenance and calibration, and 1 hour to travel to and from the site where the examination is given. MSHA estimates travel expenses to be \$100.

Surface Coal Mine Operators

MSHA estimates that annual costs for persons to take examinations to maintain certification are \$26,900. Costs for each mine size are shown below:

- \$4,057 in mines with 1-19 employees [$(22 \text{ persons taking the examination} \times (3 \text{ hrs.} \times \$28.13 \text{ hourly wage rate}) + \$100 \text{ travel expense})$];
- \$19,914 in mines with 20-500 employees [$(108 \text{ persons taking the examination} \times (3 \text{ hrs.} \times \$28.13 \text{ hourly wage rate}) + \$100 \text{ travel expense})$]; and
- \$2,950 in mines with 501+ employees [$(16 \text{ persons taking the examination} \times (3 \text{ hrs.} \times \$28.13 \text{ hourly wage rate}) + \$100 \text{ travel expense})$].

Sampling; General And Technical Requirements

Cost Estimates to Train Miners Expected to Use a CPDM

Final § 90.201(h) requires that CPDM training be provided to all part 90 miners. The training shall be completed prior to a miner being required to wear a CPDM and repeated every 12 months thereafter. The training includes: 1) the importance of monitoring dust concentrations and properly wearing the CPDM; 2) explaining the basic features and capabilities of the CPDM; 3) discussing the various types of information displayed by the CPDM and how to access that information; and 4) how to start and stop a short-term sample run during compliance sampling. MSHA estimates that it takes a person certified in sampling with a CPDM, earning \$28.13 per hour 30 minutes (0.5 hours) to train each part 90 miner, earning \$31.26 per hour. MSHA assumes that training will occur in the first year that the final rule is in effect.

Surface Coal Mine Operators

MSHA estimates that annual costs for surface coal mine operators to provide CPDM training to part 90 miners are \$5,900. Costs for each mine size are shown below:

- \$891 in mines with 1-19 employees [$30 \text{ persons} \times ((0.5 \text{ hrs.} \times \$28.13 \text{ hourly wage rate}) + (0.5 \text{ hrs.} \times \$31.26 \text{ hourly wage rate}))$];
- \$4,395 in mines with 20-500 employees [$148 \text{ persons} \times ((0.5 \text{ hrs.} \times \$28.13 \text{ hourly wage rate}) + (0.5 \text{ hrs.} \times \$31.26 \text{ hourly wage rate}))$]; and
- \$653 in mines with 501+ employees [$22 \text{ persons} \times ((0.5 \text{ hrs.} \times \$28.13 \text{ hourly wage rate}) + (0.5 \text{ hrs.} \times \$31.26 \text{ hourly wage rate}))$].

Cost Estimate to Record CPDM Training

Final § 90.201(i) requires coal mine operators to keep a record of CPDM training. MSHA estimates that it takes a clerical employee, earning \$23.91 per hour, 30 seconds (0.0083 hours) to make a record of the CPDM training.

Surface Coal Mine Operators

MSHA estimates that annual costs to make a record of CPDM training for part 90 miners are \$40. Costs for each mine size are shown below:

- \$6 in mines with 1-19 employees [30 persons x (0.0083 hrs. x \$23.91 hourly wage rate)];
- \$29 in mines with 20-500 employees [148 persons x (0.0083 hrs. x \$23.91 hourly wage rate)]; and
- \$4 in mines with 501+ employees [22 persons x (0.0083 hrs. x \$23.91 hourly wage rate)].

Cost Estimates to Purchase Computer and other Equipment When Using a CPDM to Sample

Final § 90.201(a) requires that 18 months after the effective date of the rule, part 90 miners must be sampled using a CPDM. Final § 90.208(f) requires that if using a CPDM, all sample data file information collected and stored in the CPDM must be transmitted electronically to MSHA within 24 hours after the end of each sampling shift. Final § 90.209(c) requires the person certified in sampling to print, sign, and provide a paper record (Dust Data Card) of the sample run to the part 90 miner within one hour after the start of the part 90 miner's next shift. As a result of these provisions, MSHA estimates that some operators will need to purchase additional computers.

Final § 90.204(d) requires that when CPDMs are used, a certified person in sampling or in maintenance and calibration shall follow the pre-operational examinations, testing and set-up procedures, and perform necessary external maintenance recommended by the manufacturer. In the PREA, MSHA determined that to perform the required monthly calibration on a CPDM, some operators would need to purchase a flow meter to conduct a flow audit. For this analysis, the Agency retains this position and estimates that, when using a CPDM to sample part 90 miners at surface coal mines, operators will need to purchase equipment to: transmit CPDM data to MSHA under final § 90.208(f)); and to calibrate CPDMs. Since there will be less sampling performed with the CPDM at surface coal mines than at underground coal mines, MSHA estimates that surface coal mine operators will need to purchase only one computer, printer, and flow meter. MSHA estimates that these costs total \$2,700 (\$1,000 for a computer and printer, including ink and paper, and \$1,700 for a flow meter). MSHA assumes that the equipment will be purchased in the first year that the final rule is in effect.

Surface Coal Mine Operators

MSHA estimates that first year costs for operators to purchase equipment when using a CPDM to sample part 90 miners are \$540,000. Costs for each mine size are shown below:

- \$81,000 in mines with 1-19 employees (30 operators x \$2,700);
- \$399,600 in mines with 20-500 employees (148 operators x \$2,700); and

- \$59,400 in mines with 501+ employees (22 operators x \$2,700).

MSHA estimates a 5-year service life for the computer, printer, and flow meter. Thus, first year cost estimates are annualized over a 5-year period by multiplying by a factor of 0.244 based on a 7 percent discount rate to arrive at an annualized cost estimate of \$131,775.

Cost Estimates to Purchase CPDMs

Under final §§ 90.201(a) and 90.207(a), beginning 18 months after the effective date of the final rule, operators are required to use CPDMs to sample the work environment of each part 90 miner. Five valid representative samples will be taken for each part 90 miner during each calendar quarter. This will allow time within each sampling period for surface coal mine operators to address any repair problems that might occur with the CPDMs. However, to be conservative, MSHA increased the estimates of the number of CPDMs needed at surface coal mines by 10 percent to account for reliability issues that may arise with the CPDM. Thus, MSHA estimates that the number of CPDMs needed are: 33 CPDMs at surface coal mines with 1-19 persons (30 CPDMs x 1.10); 163 CPDMs at mines with 20-500 employees (148 CPDMs x 1.10); and 24 CPDMs at mines with 501+ employees (22 CPDMs x 1.10).

MSHA assumes that the CPDMs will be purchased in the first year that the final rule is in effect. In the PREA, MSHA estimated that the average cost for a CPDM was \$10,000 and each unit purchased would incur an extended warranty cost of \$2,875. However, as noted earlier in this analysis when calculating the compliance costs to underground coal mine operators to purchase CPDMs, MSHA revised its analysis to a cost of \$12,900 per CPDM and that 25 percent of the purchased CPDMs would include the purchase of an extended 5-year warranty at \$2,875. MSHA uses these same revised cost estimates to derive costs for this provision.

Surface Coal Mine Operators

MSHA estimates that first year costs for operators to purchase CPDMs are \$3 million. Costs for each mine size are shown below:

- \$449,419 in mines with 1-19 employees [(33 CPDMs x \$12,900) + (33 CPDMs x 0.25 x \$2,875)];
- \$2,219,856 in mines with 20-500 employees [(163 CPDMs x \$12,900) + (163 CPDMs x 0.25 x \$2,875)]; and
- \$326,850 in mines with 501+ employees [(24 CPDMs x \$12,900) + (24 CPDMs x 0.25 x \$2,875)].

MSHA estimates a 5-year service life for a CPDM. Thus, first year cost estimates are annualized over a 5-year period by multiplying by a factor of 0.244 based on a 7 percent discount rate to arrive at annualized cost estimate of \$731,100.

MSHA's estimate of the costs to purchase CPDMs may be lower for the following reasons: The derivation of the above costs to purchase CPDMs assumes that the CPDM has a life of five years. This assumption means that a coal mine operator that purchased CPDMs to comply with the final rule will need to purchase them again 5 years after initial purchase. However, the manufacturer of the CPDM has commented that the company expects the "minimum" life of the CPDM to be 5 years. If it turns out that the average life of the CPDM in the coal mining industry is longer than 5 years, then the re-purchase of CPDMs can be extended beyond five years resulting in lower annualized cost estimates for the CPDMs. This is

particularly likely for surface coal mines, which will conduct much less CPDM sampling than underground coal mines.

Further, surface coal mines located close to each other may decide to share CPDMs. Since the final rule requires only 5 valid representative part 90 miner samples per quarter there will be many non-sampling days in a quarter in which a mine can share its CPDMs with a mine located nearby.

Cost Estimates to Purchase CPDM Filters

Eighteen months after the effective date of the final rule, the mine operator is required to sample each part 90 miner 5 times per quarter using a CPDM. Thus, the number of part 90 miner samples taken under the final rule will be: none in the first year that the final rule is in effect; 10 part 90 miner samples in the second year that the final year is in effect (5 samples x 2 quarters); and 20 part 90 miner samples in the third year, and every year thereafter that the final rule is in effect (5 samples x 4 quarters). A new CPDM filter is needed for each CPDM used on every shift sampled. MSHA estimates that a CPDM filter costs \$6.50. In the PREA, MSHA estimated a cost of \$5.50 per filter. Although the price per filter decreases as the volume order increases, a commenter indicated paying a price of \$6.50 per CPDM filter. MSHA has increased the price per filter to \$6.50 for this analysis of the final rule.

Surface Coal Mine Operators

First Year of Final Rule

There are no costs for sampling part 90 miners at surface coal mines in the first year that the rule becomes effective.

Second Year of Final Rule

MSHA estimates that for the second year that the final rule is in effect, surface coal mine operators' costs for CPDM filters are \$13,000. Costs for each mine size are shown below.

- \$1,950 in mines with 1-19 employees (30 part 90 miners x 5 samples x 2 quarters x \$6.50 per filter);
- \$9,620 in mines with 20-500 employees (148 part 90 miners x 5 samples x 2 quarters x \$6.50 per filter); and
- \$1,430 in mines with 501+ employees (22 part 90 miners x 5 samples x 2 quarters x \$6.50 per filter).

Third Year of Final Rule and Every Year Thereafter

MSHA estimates that for the third year that the final rule is in effect, surface coal mine operators' costs for CPDM filters is \$26,000. Costs for each mine size are shown below.

- \$3,900 in mines with 1-19 employees (30 part 90 miners x 5 samples x 4 quarters x \$6.50 per filter);
- \$19,240 in mines with 20-500 employees (148 part 90 miners x 5 samples x 4 quarters x \$6.50 per filter); and
- \$2,860 in mines with 501+ employees (22 part 90 miners x 5 samples x 4 quarters x \$6.50 per filter).

Under the final rule, the cost for CPDM filters in surface coal mines changes each year until the third year, after which it remains constant. The Agency estimated costs that will be

incurred over a 10-year period by multiplying each year's costs (excluding the costs in the first year) by a discount factor. MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at annual cost estimates of: \$3,349 for mines with 1-19 employees; \$16,521 for mines with 20-500 employees; and \$2,456 for mines with 501+ employees.

Cost Estimates for CPDM Annual Maintenance

Final § 90.204(d) requires that when CPDMs are used, a certified person in sampling or in maintenance and calibration follow the examination, testing, and set-up procedures. According to the manufacturer's recommendations, the following maintenance must be performed on a CPDM each month: clean cyclone and inlet tubing; perform a sample line leak check; and perform a flow audit procedure.

There were no comments on the derivation of the CPDM annual maintenance costs. Therefore, the method used in the PREA to estimate annual maintenance costs is also used in this analysis, with the exception that hourly wage rates have been updated. MSHA estimates that maintenance by a certified person earning \$28.13 per hour takes 45 minutes (0.75 hours), of which: 35 minutes is to clean cyclone and inlet tubing; 5 minutes is for a sample line leak check; and 5 minutes is for a flow audit. Since the CPDMs used to sample the part 90 miner at surface coal mines will be sampling each calendar quarter on consecutive workdays to collect 5 valid representative samples, MSHA assumes that this maintenance will be done 4 months of the year. Thus, the annual cost to perform the monthly maintenance procedure on a CPDM is approximately \$85 (4 mos. x 0.75 hrs. x \$28.13 hourly wage rate). In addition, the manufacturer recommends that a calibration audit be performed on the CPDM once a year. MSHA estimates the audit will cost \$28 (1 hr. per audit x \$28.13 hourly wage rate).

MSHA expects that parts on the CPDM unit may need to be replaced periodically. Manufacturer costs for high-end replacement parts range from \$200 for a front case assembly to \$1,300 for the LED cap lamp assembly. Low-end replacement parts, such as peel-away overlay clear covers that protect the glass showing the CPDM read out, a grit pot, or detachable power cord, each cost less than \$40. MSHA does not expect that each CPDM will need these items replaced annually. As noted earlier, testing by NIOSH indicates that these devices are very reliable and durable. However, as these CPDMs are used in the mining environment, they will be damaged and replacement parts will be needed. Previously, MSHA projected annual parts replacement and shipping costs would be \$1,000 for CPDMs used in underground coal mines. However, under the final rule, the number of CPDM samples that operators at surface coal mines are required to take for part 90 miners will be less than the CPDM samples that operators at underground coal mines are required to take for DOs, ODOs, and part 90 miners. Under the final rule, surface coal mine operators are required to use CPDMs for only part 90 sampling, which means only 20 valid representative samples per year are required for each part 90 miner (5 samples x 4 quarters per year x 1 part 90 miner). Since the CPDM will be used infrequently at surface coal mines and for much less sampling than in underground coal mines, MSHA does not expect that annual maintenance costs for a CPDM used in a surface coal mine will be \$1,000 per year. MSHA assumes that annually CPDM replacement parts and shipping cost will be 25 percent of \$1,000, or \$250.

MSHA estimates that at surface coal mines the total annual maintenance costs for a CPDM used to conduct part 90 miner sampling is \$363 (\$85 + \$28 + \$250).

Surface Coal Mine Operators

First Year of Final Rule

There are no annual maintenance costs for CPDMs used to perform part 90 miner sampling at surface coal mines in the first year that the rule is in effect.

Second Year of Final Rule and Every Year Thereafter

CPDMs are not required to be used until 18 months after the effective date of the final rule, or during the latter half of the second year that the final rule is in effect. Thus, the first full year in which CPDMs will be used will be in the third year that the final rule is in effect. Although CPDMs will be used for part 90 sampling during half the second year that the final rule is in effect, and during the full third year and every year thereafter, MSHA assumes the annual maintenance costs are the same in the second and subsequent years. Therefore, MSHA estimates that in the second year of the final rule, and every year thereafter, surface coal mine operators' annual maintenance costs for CPDMs used for part 90 miner sampling is \$72,600. Costs for each mine size are shown below.

- \$10,890 in mines with 1-19 employees (30 CPDMs x \$363 for annual maintenance);
- \$53,724 in mines with 20-500 employees (148 CPDMs x \$363 for annual maintenance); and
- \$7,986 in mines with 501+ employees (22 CPDMs x \$363 for annual maintenance).

Under the final rule, the annual maintenance costs for CPDMs used to perform part 90 miner sampling at surface coal mines begins in the second year and remains constant. The Agency estimated costs that will be incurred over a 10-year period by multiplying each year's costs by a discount factor. MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at annual cost estimates of: \$10,073 for mines with 1-19 employees; \$49,694 for mines with 20-500 employees; and \$7,387 for mines with 501+ employees.

Cost Estimates for Before Shift CPDM Maintenance

Based on manufacturer's recommendations, after the CPDM has been used on a shift and before it can be used again, the Tapered Element Oscillating Microbalance (TEOM®) filter must be replaced and the grit pot, mass transducer area and sample lines must be cleaned. In addition, the CPDM has to be programmed before each shift on which it is used. MSHA estimates that it takes a certified person earning \$28.13 per hour 15 minutes (0.25 hours) to perform the above tasks before every shift that a CPDM is used for part 90 miner sampling. Since a new filter must be used each time a CPDM is used for sampling, the number of times per year that this maintenance must be done corresponds to the estimated number of CPDM filters calculated previously. Thus, the number of times that this maintenance is performed per part 90 miner sampled will be: none in the first year that the final rule is in effect; 10 times in the second year that the final year is in effect; and 20 times in the third year, and every year thereafter, that the final rule is in effect.

Surface Coal Mine Operators

First Year of Final Rule

There are no before shift maintenance costs for using CPDMs for part 90 miner sampling at surface coal mines in the first year that the rule is in effect.

Second Year of Final Rule

MSHA estimates that for the second year that the final rule is in effect, the costs to surface coal mine operators to conduct CPDM maintenance before each shift that the CPDM is used for sampling are \$14,100. Costs for each mine size are shown below.

- \$2,110 in mines with 1-19 employees [30 CPDMs x 10 times to conduct before shift maintenance x (0.25 hrs. x \$28.13 hourly wage rate);
- \$10,408 in mines with 20-500 employees [148 CPDMs x 10 times to conduct before shift maintenance x (0.25 hrs. x \$28.13 hourly wage rate); and
- \$1,547 in mines with 501+ employees [22 CPDMs x 10 times to conduct before shift maintenance x (0.25 hrs. x \$28.13 hourly wage rate).

Third Year of Final Rule and Every Year Thereafter

MSHA estimates that for the third year that the final rule is in effect, the costs to surface coal mine operators to conduct CPDM maintenance before each shift that the CPDM is used for sampling are \$28,130. Costs for each mine size are shown below.

- \$4,220 in mines with 1-19 employees [30 CPDMs x 20 times to conduct before shift maintenance x (0.25 hrs. x \$28.13 hourly wage rate);
- \$20,816 in mines with 20-500 employees [148 CPDMs x 20 times to conduct before shift maintenance x (0.25 hrs. x \$28.13 hourly wage rate); and
- \$3,094 in mines with 501+ employees [22 CPDMs x 20 times to conduct before shift maintenance x (0.25 hrs. x \$28.13 hourly wage rate).

Under the final rule, these CPDM maintenance costs at surface coal mines change each year until the third year, after which it remains constant. The Agency estimated costs that will be incurred over a 10-year period by multiplying each year's costs (excluding the costs in the first year) by a discount factor. MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at annual cost estimates of: \$3,623 for mines with 1-19 employees; \$17,874 for mines with 20-500 employees; and \$2,657 for mines with 501+ employees.

Cost Estimates to Validate, Certify, and Transmit CPDM Sampling Data to MSHA

Final § 90.208(f) requires that within 24 hours after the end of each sampling shift, a person certified in sampling must validate, certify and transmit electronically to MSHA the sample data file information collected and stored in the CPDM, including sampling status conditions encountered when sampling a part 90 miner. MSHA estimates that validating, certifying, and uploading the CPDM data from a CPDM to a computer, and then transmitting it electronically to MSHA takes a certified person, earning \$28.13 per hour, 6 minutes (0.1 hours). Since a new CPDM filter must be used for each part 90 miner sample, the number of data files that operators must validate, certify, and transmit to MSHA is the same as the number of CPDMs filters and will be: none in the first year that the final rule is in effect; 10 times in the second year that the final rule is in effect; and 20 times in the third year and every year thereafter that the final rule is in effect.

Surface Coal Mine Operators

First Year of Final Rule

There are no costs for validating, certifying, and transmitting sample data files from CPDMs used to perform part 90 miner sampling at surface coal mines in the first year that the rule is in effect.

Second Year of Final Rule

Based on the above discussion, MSHA estimates that for the second year that the final rule is in effect, surface coal mine operators' costs to validate, certify, and transmit sample data files from CPDMs used to perform part 90 miner sampling are \$5,600. Costs for each mine size are shown below.

- \$844 in mines with 1-19 employees [30 part 90 miners x 10 times to transmit data x (0.1 hrs. x \$28.13 hourly wage rate);
- \$4,163 in mines with 20-500 employees [148 part 90 miners x 10 times to transmit data x (0.1 hrs. x \$28.13 hourly wage rate); and
- \$619 in mines with 501+ employees [22 part 90 miners x 10 times to transmit data x (0.1 hrs. x \$28.13 hourly wage rate).

Third Year of Final Rule and Every Year Thereafter

Based on the above discussion, MSHA estimates that for the third year that the final rule is in effect, surface coal mine operators' costs to validate, certify and transmit sample data files from CPDMs used to perform part 90 miner sampling are \$11,300. Costs for each mine size are shown below.

- \$1,688 in mines with 1-19 employees [30 CPDMs x 20 times to transmit data x (0.1 hrs. x \$28.13 hourly wage rate);
- \$8,326 in mines with 20-500 employees [148 CPDMs x 20 times to transmit data x (0.1 hrs. x \$28.13 hourly wage rate); and
- \$1,238 in mines with 501+ employees [22 CPDMs x 20 times to transmit data x (0.1 hrs. x \$28.13 hourly wage rate).

Under the final rule, the costs related to validating, certifying and transmitting sample data files from CPDMs used to perform part 90 miner sampling at surface coal mines changes each year until the third year, after which it remains constant. The Agency estimated costs that will be incurred over a 10-year period by multiplying each year's costs (excluding the costs in the first year) by a discount factor. MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at annual cost estimates of: \$1,449 for mines with 1-19 employees; \$7,150 for mines with 20-500 employees; and \$1,063 for mines with 501+ employees.

Cost Estimates to Sign and Provide CPDM Sampling Data to Part 90 Miners

Final § 90.209(b) requires operators to provide a copy of the MSHA sampling data report to the sampled part 90 miner. Final § 90.209(c) requires that when using a CPDM, operators must print, sign, and provide to each part 90 miner a paper record (Dust Data Card) of the sample run for the part 90 miner, which includes: 1) the mine identification number; 2) the location within the mine from which the sample was taken; 3) the concentration of respirable dust,

expressed as an equivalent 8-hour concentration reported and stored for each sample; 4) the sampling status conditions encountered for each sample; 5) the shift length; and 6) the part 90 miner's MSHA Individual Identification Number (MIIN). This information is included on the CPDM Dust Data Card. MSHA estimates that the information not included on the CPDM printout will be written down on the printout.

Final § 90.201(f) requires the operator to make a record showing the length of each shift for each part 90 miner, retain the records for at least six months, make them available for inspection by authorized representatives of the Secretary, and submit them to the MSHA District Manager when requested in writing. MSHA assumes that operators will record in a book the shift length to comply with final § 90.201(f) when they print out the Dust Data Card.

A new CPDM filter is used every time a CPDM is used to sample; also a printout of the information noted above, with the exception of the shift length, is generated after the sample is taken. Thus, the number of times printouts will be provided to part 90 miners is equal to the number of CPDM filters. Printouts required under final § 90.209(b) and (c) can be provided to the part 90 miner at the same time. MSHA estimates that a certified person, earning \$28.13 per hour, takes 3 minutes (0.05 hours) to perform the functions described above (including writing the shift length on the printout) and making a copy of the print out. MSHA also estimates it costs \$0.15 to make a copy of each printout of the sampling data.

First Year of Final Rule

There are no costs to print, sign, and provide to part 90 miners the sampling data from CPDMs used to sample part 90 miners at surface coal mines in the first year that the rule is in effect.

Second Year of Final Rule

MSHA estimates that for the second year the final rule is in effect, surface coal mine operators' costs to print, sign, and provide to part 90 miners sampling data from CPDMs used to sample part 90 miners are \$3,100. Costs for each mine size are shown below.

- \$467 in mines with 1-19 employees [30 part 90 miners x 10 times to provide sampling data x ((0.05 hrs. x \$28.13 hourly wage rate)) + (1 copy x \$0.15 per copy));
- \$2,304 in mines with 20-500 employees [148 part 90 miners x 10 times to provide sampling data x ((0.05 hrs. x \$28.13 hourly wage rate)) + (1 copy x \$0.15 per copy)); and
- \$342 in mines with 501+ employees [22 part 90 miners x 10 times to provide sampling data x ((0.05 hrs. x \$28.13 hourly wage rate)) + (1 copy x \$0.15 per copy)).

Third Year of Final Rule and Every Year Thereafter

Based on the above discussion, MSHA estimates that for the third year the final rule is in effect, surface coal mine operators' costs to print, sign, and provide to part 90 miners sampling data from CPDMs used to sample part 90 miners are \$6,200. Costs for each mine size are shown below.

- \$934 in mines with 1-19 employees [30 part 90 miners x 20 times to provide sampling data x ((0.05 hrs. x \$28.13 hourly wage rate)) + (1 copy x \$0.15 per copy));
- \$4,607 in mines with 20-500 employees [148 part 90 miners x 20 times to provide sampling data x ((0.05 hrs. x \$28.13 hourly wage rate)) + (1 copy x \$0.15 per copy)); and

- \$685 in mines with 501+ employees [22 part 90 miners x 20 times to provide sampling data x ((0.05 hrs. x \$28.13 hourly wage rate)) + (1 copy x \$0.15 per copy)).

Under the final rule, the costs to print, sign and provide to part 90 miners sampling information from CPDMs used to sample part 90 miners at surface coal mines changes each year until the third year, after which it remains constant. The Agency estimated costs that will be incurred over a 10-year period by multiplying each year's costs (excluding the costs in the first year) by a discount factor. MSHA then summed these discounted costs and annualized them over 10 years by multiplying by a factor of 0.142 based on a 7 percent discount rate to arrive at annual cost estimates of: \$802 for mines with 1-19 employees; \$3,956 for mines with 20-500 employees; and \$588 for mines with 501+ employees.

Table IV-39 shows, by mine size, MSHA's estimates of first year costs that surface coal mine operators will incur (costs that occur in the first year which do not repeat every year plus annual costs) for using CPDMs to sample part 90 miners. MSHA estimates total first year costs of \$3.9 million.

Table IV-39: Surface Coal Mine Operators' First Year Cost Estimates to Sample Part 90 Miners with CPDMs

Requirements	Mines with 1-19 Emp.	Mines with 20-500 Emp.	Mines with 501+ Emp.	Totals
Surface Coal Operators				
Cost to Certify Persons	\$36,380	\$179,477	\$26,679	\$242,536
Turnover Cost Related to Certified Persons	\$1,213	\$5,457	\$606	\$7,276
Certified Persons Taking Exams for Certification	\$4,057	\$19,914	\$2,950	\$26,921
CPDM Training for Part 90 Miners	\$891	\$4,395	\$653	\$5,939
CPDM Training Records	\$6	\$29	\$4	\$40
CPDM Related Equipment	\$81,000	\$399,600	\$59,400	\$540,000
Purchase CPDMs	\$449,419	\$2,219,856	\$326,850	\$2,996,125
Purchase CPDM Filters	\$3,349	\$16,521	\$2,456	\$22,326
CPDM Annual Maintenance	\$10,073	\$49,694	\$7,387	\$67,154
CPDM Before Shift Maintenance	\$3,623	\$17,874	\$2,657	\$24,154
Validate, Certify & Transmit CPDM Data	\$1,449	\$7,150	\$1,063	\$9,662
Costs Related to Providing Sample Data to Part 90 Miner	\$802	\$3,956	\$588	\$5,346
Totals	\$592,261	\$2,923,923	\$431,294	\$3,947,479

First Year Costs include: costs that occur in the first year that do not repeat every year plus the annual costs. Other costs in this table change in various years and then obtain equilibrium. For these costs, the present value was taken each year for a 10-year period and then summed. The sum was then annualized over a 10-year period at a 7 percent discount rate.

Table IV-40 shows, by mine size, MSHA's estimates of annualized costs that surface coal mine operators will incur (annualizing the costs that occur in the first year which do not

repeat every year plus the annual costs) for using CPDMs to sample part 90 miners. MSHA estimates total annualized costs of \$1.1 million.

Table IV-40: Surface Coal Mine Operators' Annualized Cost Estimates to Sample Part 90 Miners with CPDMs

Requirements	Mines with 1-19 Emp.	Mines with 20-500 Emp.	Mines with 501+ Emp.	Totals
Surface Coal Operators				
Cost to Certify Persons	\$5,166	\$25,486	\$3,788	\$34,440
Turnover Cost Related to Certified Persons	\$1,213	\$5,457	\$606	\$7,276
Certified Persons Taking Exams for Certification	\$4,057	\$19,914	\$2,950	\$26,921
CPDM Training for Part 90 Miners	\$891	\$4,395	\$653	\$5,939
CPDM Training Records	\$6	\$29	\$4	\$40
CPDM Related Equipment	\$19,764	\$97,502	\$14,494	\$131,760
Purchase CPDMs	\$109,658	\$541,645	\$79,751	\$731,055
Purchase CPDM Filters	\$3,349	\$16,521	\$2,456	\$22,326
CPDM Annual Maintenance	\$10,073	\$49,694	\$7,387	\$67,154
CPDM Before Shift Maintenance	\$3,623	\$17,874	\$2,657	\$24,154
Validate, Certify & Transmit CPDM Data	\$1,449	\$7,150	\$1,063	\$9,662
Costs Related to Providing Sample Data to Part 90 Miner	\$802	\$3,956	\$588	\$5,346
Totals	\$160,050	\$789,623	\$116,399	\$1,066,072

Annualized Costs = annualizing the costs which occur in the first year over the relevant service life of equipment (typically five or ten years), plus ongoing costs.

ECONOMIC FEASIBILITY

MSHA has traditionally used a revenue screening test—whether the annualized compliance costs of a regulation are less than 1 percent of revenues, or are negative (i.e., provide net cost savings)—to establish presumptively that compliance with the regulation is economically feasible for the mining industry.¹⁶ Additionally, recent Census Bureau data shows mining in general with operating profits greater than 17 percent of sales and corresponding after tax profits of approximately 10 percent. The Agency believes that with these average profit levels, when the cost of a regulation has less than a 1 percent impact on the affected industry's revenues it is generally appropriate to conclude that the regulation is feasible.

Based on this test, MSHA has concluded that the requirements of the final rule are economically feasible. MSHA estimates that the annualized costs of the final rule, including

¹⁶ Economic feasibility is a Mine Act requirement and has been interpreted by the courts.

transfer payments, to underground coal mine operators is \$27.1 million (\$26.2 million of compliance costs and \$0.9 million of transfer payments for penalties), which is 0.13 percent of total annual revenue of \$20.2 billion ($\$27.1 \text{ million} / \20.2 billion) for all underground coal mines. MSHA estimates that annualized costs of the final rule, including transfer payments, to surface coal mine operators is \$4.02 million (\$4.0 million of compliance costs and \$24,900 of transfer payments for penalties), which is 0.02 percent of total annual revenue of \$17.9 billion ($\$4.02 \text{ million} / \17.9 billion) for all surface coal mines. Since the compliance cost estimates for both underground and surface coal mines are below one percent of their estimated annual revenue, MSHA concludes that compliance with the provisions of the final rule will be economically feasible for the coal industry.

V. BENEFITS

INTRODUCTION

This section presents a summary of the estimated benefits resulting from this final rule by reducing the adverse health effects, including deaths, associated with existing levels of respirable coal mine dust exposure under the existing standard. MSHA's benefits estimate is based on the Quantitative Risk Assessment (QRA) for the final rule, which focused on the effects of the lowering of the standard to 1.5 mg/m³ for most miners, (0.5 mg/m³ for intake air courses and part 90 miners) and the use of single shift samples by MSHA's inspectors to determine noncompliance.

MSHA's QRA for the final rule estimated the benefits for five major adverse health effects of exposure to respirable coal mine dust: coal workers' pneumoconiosis: category 1 and category 2 (CWP 1+ and CWP 2+); progressive massive fibrosis (PMF); severe emphysema; and fatality due to non-malignant respiratory disease (NMRD). In the QRA for the final rule, the Agency estimated the risk, as of age 73 for miners with a 45-year working lifetime, for each of the five adverse health effects, per thousand exposed miners in various work locations under the existing and final standards.

MSHA multiplied the reduction of risk per thousand exposed miners by the current number of coal miners estimated to be in each occupation. MSHA monetized the estimated reductions in cases of the five major adverse health effects to develop the total estimated undiscounted benefit of \$3.4 billion.

MSHA estimated monetized benefits for a 65-year analysis period to account for employee turnover and the time needed to realize a reduction in premature mortality and disease. This 65-year period represents the 45-year working lifetime plus a lag of about 20 years. Almost no benefits are projected during the first decade following the effective date of the final rule. Benefits are projected to increase during the second and third decades as the current workforce is replaced by miners without previous coal dust exposure and as sufficient time passes for the benefits of the final rule to become evident as reductions in premature mortality and disease. After several decades, a "steady state" is achieved where the projected annual benefit is \$76.5 million (the \$3.4 billion divided by 45 working life years).

MAJOR ISSUES IMPACTING BENEFITS

Major issues that impact benefits include: the adverse health effects from exposure to respirable coal mine dust; health risks under the existing standard; estimated health risks under the final standard; and the estimated benefits resulting from changes under the final rule to 30 CFR Part 70 (underground coal mines), 30 CFR Part 71 (surface coal mines and surface work areas of underground coal mines), 30 CFR Part 72 (health standards for coal mines), and 30 CFR part 90 (coal miners who have evidence of the development of pneumoconiosis and elect to work in a less dusty area).

The major requirements of the final rule include: lowering the existing concentration limits for respirable coal mine dust; use of single, full-shift MSHA Inspector samples to

determine compliance; redefining the term normal production shift; requiring full-shift sampling; and requiring more frequent sampling of selected occupations and locations using the CPDM.

MSHA based its benefits estimate on the QRA for the proposed rule on the effects of lowering the standard to 1.0 mg/m³ for most miners (0.5 mg/m³ for part 90 miners¹⁷), and the use of inspector single shift samples to determine noncompliance. For the final rule, MSHA lowers the existing 2.0 mg/m³ standard to 1.5 mg/m³. The QRA for the final rule uses the same methodology that was used in the QRA for the proposed rule.

As in the QRA for the proposed rule, MSHA's QRA for the final rule compares the risks for two hypothetical cohorts of miners with the same occupation/coal rank. One cohort, designed to characterize risks to the current workforce, was assigned 45-year lifetime exposures based on current sampling data.

The comparison cohort was assigned 45-year lifetime exposures designed to represent risks associated with two provisions of the final rule (i.e., lowering the existing standard from 2.0 mg/m³ to 1.5 mg/m³, and basing noncompliance determinations on a single MSHA inspector sample rather than the average of 5 samples as under the existing dust standard).

Since the two cohorts compared are independent, there are two caveats: 1) no benefits were projected for delaying or stopping the progression of disease among the population that experienced respirable coal mine dust exposure during their working lifetime; and 2) due to the latency between exposure and disease, especially for severe emphysema, a large portion of the benefits estimated by this analysis are not expected to accrue for many years.

For the proposed rule, the PREA did not recognize that there would be benefits for delaying or stopping the progression of disease for miners already exposed under the existing rule (the current workforce) and used, in one of its two sets of benefits calculations, a 10-year lag because of the latency between exposure and disease (the other set of calculations included no latency accounting). For the final rule, the REA uses an expected value probability approach to represent latency and to include the possibility of capturing benefits to the existing workforce.

For the proposed rule, MSHA assumed additional reductions in adverse health effects from two provisions: 1) adjusting respirable coal mine dust samples to an equivalent 8-hour concentration for work shifts longer than eight hours, and 2) redefining the term normal production shift. After considering comments and relevant data, the final rule does not require adjustments for shifts longer than 8 hours; therefore, the reductions in adverse health effects associated with this provision are no longer assumed.

In the final rule, MSHA continues to estimate that, for miners and ex-miners at age 73 with 45-year working lifetimes, two provisions (i.e., lowering the concentration limit for respirable coal mine dust and basing determinations of noncompliance on a single MSHA inspector sample rather than the average of 5 inspector samples) will prevent: 593 cases of coal workers' pneumoconiosis (CWP 1+); 473 cases of CWP 2+; 319 cases of progressive massive

¹⁷ Although the 0.5 mg/m³ applies to part 90 miners and intake air courses, the air intake samples were not included in the risk analysis used by the benefit estimate. Therefore, quantified benefits and QRA risk references will not include the intake air courses.

fibrosis (PMF); 248 cases of severe emphysema; and 26 deaths from non-malignant respiratory disease (NMRD).

For the final rule, MSHA continues to assume additional reductions in adverse health effects from redefining the term normal production shift. If the revised normal production shift had been in effect in 2009, the amount of dust on the samples would have been higher because of higher levels of production during sampling. Lowering respirable coal mine dust exposures from these higher levels will result in additional benefits beyond those associated with the actual recorded sampling results. MSHA used additional data from the feasibility assessment to extrapolate the further impact of the normal production shift definition under the final rule. The three provisions (lowering the respirable coal mine dust standard, use of a MSHA Inspector's single sample to determine compliance, and redefining the term normal production shift) result in an increase in the number of cases prevented to: 868 cases of CWP 1+; 655 cases of CWP 2+; 433 cases of PMF; 374 cases of severe emphysema; and 65 deaths from NMRD.

While MSHA did not quantify the benefits associated with several provisions of the final rule (e.g., sampling miner exposures for the full-shift rather than 8-hours, quarterly sampling of designated occupations, other designated occupations (ODOs) and part 90 miners using the CPDM; periodic medical surveillance examinations; and extending the part 90 option to surface coal miners), the Agency expects that the combined effect of these provisions will reduce the respirable coal mine dust levels and further protect miners from the debilitating effects of occupational respiratory disease. If the required data and quantitative models had been available, MSHA believes additional reductions in cases of other adverse health effects that result from exposure to respirable coal mine dust, such as chronic bronchitis, could have been estimated.

ADVERSE HEALTH EFFECTS FROM EXPOSURE TO RESPIRABLE COAL MINE DUST

Exposure to excessive levels of respirable coal mine dust imposes health risks on miners. Cumulative exposure to respirable coal mine dust is the main causative factor in the development of CWP 1+, CWP 2+ and PMF and severe emphysema, and death from NMRD.

MSHA considered the analysis and recommendations included in three documents that examined the program to control respirable coal mine dust in U.S. mines: MSHA's Respirable Dust Task Group Report, the National Institute for Occupational Safety and Health (NIOSH) Criteria Document on Occupational Exposure to Respirable Coal Mine Dust, and the Report of the Secretary of Labor's Advisory Committee on the Elimination of Pneumoconiosis Among Coal Mine Workers. While recognizing that significant progress had been made to reduce respirable coal mine dust levels in coal mines, these documents concluded that existing practices should be changed to provide miners with increased health protection. The final rule addresses many of the recommendations made in those documents. The primary benefit of the final rule is the reduction of occupational lung disease among coal miners that is achieved by improving the existing program to control respirable coal mine dust.

DETERMINING THE HEALTH RISKS UNDER EXISTING EXPOSURES AND APPROACH FOR DETERMINING COMPLIANCE

MSHA developed a QRA for the proposed rule, which was peer-reviewed by the Occupational Safety and Health Administration and NIOSH. The QRA for the proposed rule estimated the effects of lowering the respirable coal mine dust standard to 1.0 mg/m^3 for most miners (0.5 mg/m^3 for intake air courses and part 90 miners) and the use of operator and MSHA inspector single samples to determine noncompliance with applicable standards. The QRA for the final rule used the same models to estimate the effects of the final rule, using the 1.5 mg/m^3 standard for most miners (0.5 mg/m^3 for intake air courses and part 90 miners) and a single MSHA inspector sample to determine noncompliance.

Source of Exposure Data

The Agency based the QRA for the proposed rule and the QRA for the final rule on respirable coal mine dust exposures for the coal mining population during 2004 – 2008. MSHA primarily limited the data used for the QRA for the final rule to valid samples taken by MSHA inspectors on the first day of sampling (Day-1 samples) to reduce biases that could result from using samples taken during subsequent days of multiple-day sampling when conditions might have been altered.

From a database of nearly 200,000 inspector samples in the MSHA Standardized Information System that were taken during 2004 – 2008, the Agency excluded approximately 18,000 samples that had been voided. An additional 14,000 samples were removed because they were within 21 days of a prior inspection and thus could not be considered to have come from independent MSHA inspections. Also, 10,000 Day-1 intake air samples were excluded and 11,000 other Day-1 samples were removed because they could not be linked to an occupational exposure. After the exclusion, approximately 147,000 valid Day-1 inspector samples remained in the dataset.

Methods for Estimating Existing Exposures

MSHA developed estimates for groups of exposures, according to work location, coal "rank", and recurrency (how frequently measurements exceeded 2.0 mg/m^3 or 1.0 mg/m^3), as explained below. MSHA stratified the 2004-2008 exposure data according to work location. Each work location consisted of miners in the same job category who worked in the same general area. There were 12,634 work locations in underground coal mines, 7,811 work locations in surface coal mines, and 3,585 work locations in surface processing facilities. When there were fewer than two inspector samples for a specific job category in a specific work location, or the average of the inspector samples was less than the average of the operator samples, MSHA combined inspector and operator samples to estimate exposures. MSHA then sorted the data within each work location according to three factors:

- Occupation -- MSHA's QRAs for the proposed and final rules used 33 occupational categories, plus a separate category for part 90 miners.

- Coal rank -- Rank is a measure of carbon content. Higher rank is associated with higher risk of lung disease. MSHA's QRAs for the proposed and final rules used three coal rank categories:
 - o Anthracite;
 - o High-rank bituminous, containing less than 4 percent of moisture in air-dried coal or more than 84 percent of carbon in dry, ash-free coal; and
 - o The QRA for the proposed rule used low and medium rank bituminous coal, while the QRA for the final rule uses low rank bituminous coal.
- Recurrency class -- MSHA's QRAs for the proposed and final rules used three recurrency classes:
 - o Work locations with at least two valid samples greater than 2.0 mg/m³ in 2008;
 - o Work locations with at least two valid samples between 1.0 mg/m³ and 2.0 mg/m³ in 2008; and
 - o Work locations with no more than one valid sample greater than 1.0 mg/m³ in 2008.

Together, these three factors defined groupings of work environments that presented similar health risks to miners. These groupings (i.e., data stratified by three factors) permit the identification of high risk combinations that would likely be missed if MSHA considered just the average exposures of large groups with dissimilar risks.

Estimated Adverse Health Effects Under Existing Standards

MSHA estimated the numbers of adverse health effects that will result, as of age 73, from a 45-year working lifetime of exposures to respirable coal mine dust under existing conditions, using the existing approach to determining compliance by applying statistical modeling techniques to the estimated average exposures for groupings of work locations. MSHA's QRAs for the proposed and final rules used three exposure models to estimate the risks per thousand exposed miners of five adverse health effects:

- The risk of developing CWP 1+;
- The risk of developing CWP 2+;
- The risk of developing PMF;
- The risk of developing severe emphysema; and
- The risk of dying from NMRD, which includes emphysema, chronic bronchitis, CWP, and PMF.

Model 1. MSHA used the 1995 Attfield-Seixas model to estimate the risk of developing CWP 1+, CWP 2+, and PMF after a 45-year occupational lifetime exposure for respirable coal mine dust.

Model 2. MSHA used the model in the 2009 Kuempel *et al.* study to estimate the excess risk of developing severe emphysema over a 45-year working lifetime due to respirable coal mine dust exposure.

Model 3. MSHA used the 2008 Attfield-Kuempel *et al.* study to estimate the relative risk of death due to chronic obstructive pulmonary disease (COPD) and pneumoconiosis for average

respirable coal mine dust concentrations. This model was also used to estimate excess risk of death due to NMRD after 45 years of occupational exposure to respirable coal mine dust.

Estimated Cases per Thousand Miners based on Existing Conditions

- Pneumoconiosis. Among every 1,000 miners who work 45 years in coal mines at current exposure levels, MSHA estimates that by age 73 there will be 2 to 652 excess cases of CWP 1+, between 1 and 715 excess cases of CWP 2+, and between 1 and 643 excess cases of PMF, depending on occupation, coal rank, and recurrency class. (See QRA for the final rule Tables 13–15.)
- Emphysema. For every 1,000 miners who work 45 years in coal mines at current exposure levels with no known smoking history, MSHA estimates that by age 73 there will be 6 to 232 excess cases of severe emphysema among white miners and 10 to 306 excess cases among non-white miners, depending on occupation and recurrency class. MSHA's QRA for the final rule developed separate risk estimates for severe emphysema among white and non-white miners. MSHA does not have employment data by race; therefore, the Agency used the risk factors for white miners, which are lower than for non-whites, to estimate benefits. (See QRA for the final rule Table 16.)
- Non-Malignant Respiratory Disease. Among every 1,000 miners who work 45 years in coal mines at current exposure levels under existing conditions, MSHA estimates that, as of age 73, there will be between 1 and 132 excess deaths due to NMRD. (See QRA for the final rule Table 17.)

MSHA's QRAs for the proposed and final rules evaluated only the five adverse health effects noted above and did not address other adverse health effects that could result from exposure to respirable coal mine dust such as chronic bronchitis.

ESTIMATED IMPACT OF THE FINAL RULE ON MINERS' EXPOSURES

In the QRA for the proposed rule, MSHA projected average exposures in each work location for a cohort of miners assumed to be exposed only to conditions consistent with reducing the respirable dust standard to 1.0 mg/m³ and 0.5 mg/m³ for Part 90 miners, and the use of single shift sampling to determine noncompliance for a 45-year working lifetime. MSHA assumed the cohort did not have prior respirable coal mine dust exposures. The Agency aggregated the projections by the same groupings of work environments (recurrency class, occupation, and coal rank) as used in evaluating existing risks.

Similar to the QRA for the proposed rule, MSHA projected in the QRA for the final rule average exposures in each work location for a cohort of miners assumed to be exposed only to conditions consistent with reducing the respirable dust standard to 1.5 mg/m³ and 0.5 mg/m³ for Part 90 miners, and the use of a single shift MSHA sample to determine noncompliance for a 45-year working lifetime. Like the QRA for the proposed rule, MSHA assumed that the cohort did not have prior dust exposures and aggregated the risk projections by the same groupings of work environments as used in evaluating existing risks.

In the QRA for the final rule, MSHA made two additional adjustments to the 2008 data. For samples that currently exceed the final standards of 1.5 mg/m³, or 0.5 mg/m³ for part 90 miners, MSHA assumed reductions to exactly the final standards. Thus, for non-part 90 miners, all samples greater than 1.5 mg/m³ were replaced with 1.5 mg/m³ and, for part 90 miners, all samples greater than 0.5 mg/m³ were replaced with 0.5 mg/m³.

For samples that met the final standards of 1.5 mg/m³, or 0.5 mg/m³ for intake air courses and part 90 miners, the adjustment was more detailed. The ANCOVA analysis described in Table 19 and the associated text of the QRA for the final rule provide the definitions and descriptions of adjustments, which were necessary.¹⁸

Estimated Adverse Health Effects under the Final Rule

MSHA used the models based on the Attfield-Seixas, Kuempel *et al.*, and Attfield-Kuempel *et al.* studies described above to estimate the adverse health effects for two provisions of the final rule.

Estimated Cases per Thousand Miners Based on Lowering the Standard and Basing Compliance on a Single MSHA Sample

With the average exposures that will occur under the lower limit and basing compliance on a single MSHA inspector sample under the final rule, MSHA's QRA for the final rule estimates the following risks among every 1,000 exposed miners who work 45 years in coal mines:

- Pneumoconiosis. Among every 1,000 miners who work 45 years in coal mines, MSHA estimates that there will be excess risks of between 2 and 303 cases of CWP 1+, between 1 and 271 cases of CWP 2+, and between 1 and 197 cases of PMF by age 73, depending on occupation, coal rank, and recurrency class. The occupation associated with the lowest rate of illness is the utility man at surface anthracite mines, and the occupation associated with the highest rate of illness is the utility man in high rank bituminous mines. (See QRA for the final rule, Tables 21–23.)
- Emphysema. Among every 1,000 white miners who work 45 years in coal mines and never smoked, MSHA estimates that there will be excess risks of between 6 and 99 cases of severe emphysema by age 73, depending on occupation and recurrency class. The occupation associated with the lowest rate of illness is the crane/dragline operator in surface coal mines, and the occupation associated with the highest rate of illness is the utility man in high recurrency bituminous mines. (See QRA for the final rule, Table 24.)
- Non-Malignant Respiratory Disease. Among every 1,000 miners who work 45 years in coal mines, MSHA estimates that there will be excess risk of between 1 and 111 deaths from NMRD by age 73, depending on occupation, coal rank, and recurrency class. Several occupations at surface bituminous mines are associated with the lowest

¹⁸ The QRA for the final rule provides a sensitivity analysis for these assumptions.

mortality rate and surface occupations at anthracite mines are associated with the highest mortality rate. (See QRA for the final rule, Table 25.)

REDUCTION IN RISK UNDER THE FINAL RULE

MSHA's QRA estimated the reduction in risk that will be associated with the lower dust standard and based the determination of noncompliance on an MSHA inspector's single shift sample by subtracting the risk estimated under exposure conditions consistent with the final rule from the estimated risks based on average exposures from 2008 under the existing approach to compliance. Table V-1 shows the following reduction in risks by age 73 per 1,000 exposed miners who work 45 years in coal mines due to these two provisions:

- Pneumoconiosis. Among every 1,000 miners who work 45 years in coal mines, MSHA estimates that the two provisions will prevent up to 73 cases of CWP 1+, up to 74 cases of CWP 2+, and up to 56 cases of PMF, by age 73, for cutting machine operators at high rank bituminous underground coal mines, while other underground occupations show lower reductions in illness. At surface coal mines, several occupations are associated with the lowest reductions of illness.
- Emphysema. Among every 1,000 white miners who work 45 years in coal mines and never smoked, MSHA estimates that the two provisions will prevent up to 24 cases of severe emphysema by age 73 for cutting machine operators at high recurrency bituminous underground coal mines, while other underground occupations show lower reductions in illness. At surface coal mines, several occupations are associated with the lowest reductions of illness. As noted above, since MSHA does not have employment data by race, the Agency used the risk factors for white miners, which are lower than for non-whites, to estimate the benefits.
- Non-Malignant Respiratory Disease. Among every 1,000 miners who work 45 years in coal mines, MSHA estimates that the two provisions will prevent up to 2.4 deaths from NMRD by age 73 for cutting machine operators at high rank bituminous underground coal mines, while other underground occupations show lower reductions in deaths. At surface coal mines, several occupations are associated with the lowest reductions of illness.

Application of Risk Reduction to the Estimated Population of Miners

To estimate the number of cases of adverse health effects that would be prevented over a 45-year working life by the final rule, it is necessary to apply the estimated risk reductions to the estimated population of miners exposed to respirable coal mine dust. For the PREA, MSHA applied the occupational risk reduction estimates under the proposed standard (i.e., the numbers of cases and deaths prevented per thousand exposed miners) to the number of coal miners estimated to be in each occupation in 2009.

After publication of the proposed rule, MSHA realized that there was an error in the employment estimates used to calculate the outcomes avoided for the proposed rule. Some of the occupational categories (i.e., the "other" category for both surface and underground coal mines) included thousands of workers. For these categories, respirable coal mine dust samples

are collected by MSHA inspectors primarily in circumstances where the inspector observes conditions that raise concerns that exposures higher than permissible levels may be occurring, or the available exposure measurement data are not representative of the exposures of the entire population of production miners in coal mines. The sample data are applicable to only a subset of coal miners: those who are directly involved in or in the vicinity of operations that generate respirable coal mine dust. Thus, in the REA, the risk reduction estimates are applied to a smaller number of miners.

Table V-1: Estimated Reduction in Risk (Defined as Adverse Health Effects at Age 73 per 1,000 Exposed Miners with 45-Year Post-Finalization Working Lifetimes), by Occupation, from the Final Rule Lowering the Limit from 2.0 mg/m³ to 1.5 mg/m³ and Basing Determinations of Compliance based on MSHA's Single Samples

Occupation	CWP 1+	CWP 2+	PMF	Severe Emphysema	Deaths from NMRD
Underground Coal Miners:					
Auger Operator	22.3	18.8	12.6	8.8	0.8
Continuous Miner Operator	45.7	39.2	26.6	17.8	1.7
Cutting Machine Operator	72.9	73.7	56.1	24.0	2.4
Drill Operator	15.0	12.3	8.4	5.3	0.6
Electrician & Helper	6.0	4.1	2.6	2.6	0.3
Laborer	3.1	2.3	15	1.1	0.2
Loading Machine Operator	0.0	0.0	0.0	0.0	0.0
LW Headgate Operator	25.5	20.3	13.4	10.1	1.0
LW Jacksetter	30.8	26.4	17.7	12.4	1.1
LW Tailgate Operator	47.2	44.9	32.7	17.4	1.7
Mechanic & Helper	9.6	6.9	4.4	4.0	0.4
Mobile Bridge Operator	27.5	22.0	14.8	10.9	1.1
Roof Bolter	20.8	16.2	10.6	8.4	0.8
Scoop Car Operator	12.4	8.9	5.6	6.0	0.7
Section Foreman	6.9	5.5	3.8	2.6	0.3
Shuttle Car Operator	17.0	12.5	8.0	7.3	0.7
Uni-Hauler Operator	20.5	15.1	9.9	7.8	0.9
Utility Man	20.4	14.5	9.3	9.1	0.9
All Other Underground Jobs	19.4	17.5	13.5	7.8	0.8
Surface Coal Miners:					
Auger Operator	0.0	0.0	0.0	0.0	0.0
Backhoe Operator	0.2	0.1	0.1	0.12	0.1
Bulldozer Operator	0.2	0.1	0.5	0.11	0.01
Cleaning Plant Operator	2.4	1.5	0.8	1.4	0.2
Crane/Dragline Operator	0.0	0.0	0.0	0.0	0.0
Highwall Drill Operator	2.9	1.7	0.8	1.8	0.2
Electrician & Helper	0.1	0.1	0.04	0.8	0.01
Highlift/Front End Loader Opr	0.03	0.02	0.01	0.02	0.00
Laborer/Blacksmith	2.9	2.1	1.3	1.2	0.3
Mechanic/Helper	2.9	2.0	1.1	1.6	0.2
Tipple Operator	0.4	0.2	0.1	0.24	0.02
Truck Driver	0.08	0.04	0.02	0.05	0.00
Utility Man	3.4	2.4	1.5	1.9	0.2
All Other Surface Jobs	1.7	1.2	0.6	1.0	0.1
Part 90 Coal Miners	35.0	27.4	18.6	14.2	1.6
Source: MSHA QRA for the final rule					

In this analysis, MSHA refined the approach used in the PREA. MSHA determined that some surface coal miners are not directly involved in or in the vicinity of operations that generate respirable coal mine dust and therefore adjusted the number of miners in the following occupations: backhoe operators (50 percent), cleaning plant operators (90 percent), crane/dragline operators (50 percent), electricians and helpers (75 percent), laborers/blacksmiths (50 percent), mechanic/helpers (75 percent), tippie operators (90 percent), truck drivers (25 percent), utility men (50 percent), and "all other surface jobs" (50 percent). The latter category includes 90 occupational categories, some of whom, such as surveyors and training specialists, rarely work in areas where they are likely to be exposed to high concentrations of respirable coal mine dust.

MSHA also estimates that for underground coal mines only 75 percent of those in "all other underground jobs" are potentially exposed above the final respirable coal mine dust standard. There are 48 occupations within this category, including miners, such as supply personnel and waterline personnel, who rarely work in areas where they are likely to be exposed to high concentrations of respirable coal mine dust.

After adjusting the employment estimates, MSHA used a similar approach used in the proposed rule to estimate the number of cases of adverse health effects that would be prevented over 45 years by the final rule. MSHA multiplied the estimated risk reductions presented in Table 28 of the QRA for the final rule by the number of coal miners in each occupation in 2009 estimated to be directly involved in or in the vicinity of operations that generate respirable coal mine dust. Table V-2 shows that, for miners or ex-miners at age 73 who started 45-year working lifetimes after finalization of the rule, MSHA estimates that the two provisions considered in the QRA for the final rule will prevent 593 cases of CWP 1+, 473 cases of CWP 2+, 319 cases of PMF, 248 cases of severe emphysema, and 26 deaths from NMRD.

Table V-2: Estimated Number of Adverse Health Effects Prevented ² as of Age 73, with 45-Year Post-Finalization Working Lifetimes, from Two Provisions of the Final Rule (Lowering the Limit from 2.0 mg/m³ to 1.5 mg/m³ and Basing Determinations of Compliance on MSHA's Single Samples)

Occupation	Miners Potentially Exposed	CWP 1+	CWP 2+	PMF	Severe Emphysema	Deaths from NMRD
Underground Coal Miners:	31,339	548.0	441.7	301.4	223.6	22.5
Auger Operator	10	0.2	0.2	0.1	0.1	0.01
Continuous Miner Operator	2,305	105.3	90.4	61.3	41.0	3.9
Cutting Machine Operator	26	1.9	1.9	1.5	0.6	0.1
Drill Operator	28	0.4	0.3	0.2	0.1	0.02
Electrician & Helper	3,474	20.8	14.2	9.0	9.0	1.0
Laborer	2,287	7.1	5.3	3.4	2.5	0.5
Loading Machine Operator	307	0.0	0.0	0.0	0.0	0.00
LW Headgate Operator	253	6.5	5.1	3.4	2.6	0.3
LW Jacksetter	386	11.9	10.2	6.8	4.8	0.4
LW Tailgate Operator	133	6.3	6.0	4.3	2.3	0.2
Mechanic & Helper	830	8.0	5.7	3.7	3.3	0.3
Mobile Bridge Operator	900	24.8	19.8	13.3	9.0	1.0
Roof Bolter	5,550	115.4	89.9	58.8	46.6	4.4
Scoop Car Operator	2,009	24.9	17.9	11.3	12.1	1.4
Section Foreman	1,866	12.9	10.3	7.1	4.9	.6
Shuttle Car Operator	5,053	85.9	63.2	40.4	36.9	3.5
Uni-Hauler Operator	198	4.1	3.0	2.0	1.5	0.2
Utility Man	613	12.5	8.9	5.7	5.6	0.6
All Other UG Jobs	5,111 ¹	99.1	89.4	69.0	39.9	4.1
Surface Coal Miners:	30,504	42.5	29.0	15.9	23.8	2.8
Auger Operator	166	0.0	0.0	0.0	0.0	0.0
Backhoe Operator	528 ¹	0.1	0.1	0.0	0.1	0.01
Bulldozer Operator	3,958	0.8	0.4	0.2	0.4	0.04
Cleaning Plant Operator	536 ¹	1.3	0.8	0.4	0.8	0.1
Crane/Dragline Operator	306 ¹	0.0	0.0	0.0	0.0	0.0
Highwall Drill Operator	1,422	4.1	2.4	1.1	2.6	0.3
Electrician & Helper	1,812 ¹	0.2	0.2	0.1	0.1	0.02
Highlift/Front End Loader Opr	4,080	0.1	0.1	0.0	0.1	0.0
Laborer/Blacksmith	1,472 ¹	4.3	3.1	1.9	1.8	0.4
Mechanic/Helper	3,680 ¹	10.7	7.4	4.0	5.9	0.7
Tipple Operator	648 ¹	0.3	0.1	0.1	0.2	0.01
Truck Driver	2,295 ¹	0.2	0.1	0.0	0.1	0.00
Utility Man	2,443 ¹	8.3	5.8	3.6	4.6	0.5
All Other Surface Jobs	7,169 ¹	12.2	8.6	4.3	7.2	0.7
Part 90 Coal Miners	66	2.3	1.8	1.2	0.9	0.1
Total All Coal Miners	61,908	592.7	472.5	318.5	248.3	25.5

¹ Potentially exposed miners are under 100 percent of all miners in this occupation.

² Number of adverse health effects prevented = (Employment/1000) x (Reduction in excess risk per 1000 exposed miners)

Extrapolation of Additional Benefits from Normal Production Shift Adjustments to Determining Compliance

Neither the QRA for the proposed rule nor the QRA for the final rule considered that the sampled shifts may not have been representative of normal production shifts as defined by either the proposed or final rules. MSHA's QRAs adjusted sampling results within each work location to account for variations in production during the shifts that were sampled. Increases in production within shifts increase dust concentrations for miners on those shifts. However, the QRAs did not consider that under the existing rule for underground mines, production on a sampled shift was required to be 50 percent of the average production reported for the last set of five valid samples. If one set of samples is taken during a period of 50 percent of normal production, the next set of samples may be taken during a period when production is only at half of that level (i.e., only one quarter of normal production) and that process could continue to be repeated. This could ultimately result in samples that bear no relation to actual production.

The final rule requires that underground coal mine operators take dust samples in a mechanized mining unit when production is at least 80 percent of the average production for the most recent 30 production shifts. If the revised definition of normal production shift had been in effect in 2009, the amount of dust on the samples would have been higher because of the higher levels of production that would have occurred during sampling. Lowering exposures from these higher levels to the levels required under the final rule will result in additional risk reductions. Therefore, it was necessary for MSHA to adjust the risk reductions presented in the QRA for the final rule to estimate the benefits of this provision.

As discussed in Chapter IV of the PREA and in Section III.C.3., Technological Feasibility of Achieving the Required Dust Standards, of the preamble of the final rule, MSHA had to adjust the actual sampling data upward to account for the projected impacts of the revised definition of normal production shift. MSHA adjusted the actual sampling data upward by multiplying by 1.16 (for non-longwall MMUs) and 1.09 (for longwall MMUs) to account for the change in the definition of normal production shift. (These are the same factors that were used in the PREA to adjust for the revised definition of normal production.)

Calculation of the Adjustment Factor for Normal Production

Since the existing rule does not require operators to report production during each shift, MSHA obtained 30-shift average production estimates from on-site mine records for each of 193 MMUs inspected during October 2009. These production values were then averaged across the non-longwall and longwall MMUs, yielding 30-shift averages of 921 tons and 7,355 tons, respectively. Since these estimates were for production for the entire shift, the averages were then divided by the average shift length applicable to the MMU type to estimate average production rate in tons per hour. MSHA determined that on average longwall mines have 10-hour shifts and non-longwall mines have 9-hours shifts. The overall longwall MMU production rate was 736 tons/hour ($7,355 \text{ tons} \div 10 \text{ hrs.}$) and non-longwall MMUs production rate was 102 tons/hour ($921 \text{ tons} \div 9 \text{ hrs.}$).

On the data card submitted with each sample, operators specify the amount of coal produced during the sampling period. Since the operator samples are only collected for an 8-hour period and not for the full-shift, these estimates only represent 8 hours of production. The production reported for each operator sample collected in CY 2009 was averaged across all non-longwall and longwall MMUs. The 8-hour production averages during operator sampling

was 703 tons for non-longwall MMUs and 5,398 tons for longwall MMUs. These averages were then divided by 8 hours, yielding estimates of the average production rate by MMU type. The production rate during operator sampling was estimated at 88 tons/hour (703 tons ÷ 8 hrs.) for non-longwall MMUs and 675 tons/hour (5,398 tons ÷ 8 hrs.) for longwall MMUs.

The adjustment factors for the revised definition of normal production shift were developed by dividing the 30-shift average production rate from the 193 MMUs inspected in October 2009 by the CY 2009 average production rate for all MMUs. In the case of non-longwall MMUs, the factor is 1.16 (102 tons/hr. ÷ 88 tons/hr.); and for longwall MMUs, the factor is 1.09 (736 tons/hr. ÷ 675 tons/hr.).

Application of the Adjustment Factors for Normal Production Shift

For the proposal, MSHA assumed that the additional reduction in adverse health effects attributable to 1) the revised definition of normal production shift, and 2) sampling over a full-shift (as adjusted for the 8-hour conversion) would be proportional to the additional reduction in exposure associated with these two proposed provisions. Therefore, MSHA multiplied the estimated number of cases prevented for each occupation by the appropriate adjustment factors (as described in the PREA), to project the number of cases that would be prevented under the proposed standard.

For the final rule, MSHA divided the projected excess risk under the final rule in each work location for each adverse health effect (from Tables 21-25 in the final QRA) by a factor to account for the application of the revised definition of normal production shift.¹⁹ These products were then subtracted from the estimated risk of each adverse health effect under the existing rule (from Tables 13-17 in the final QRA) and multiplied by the estimates in Table 27 of the final QRA to develop risk reduction estimates that include the impact of the revised definition of normal production shift. These estimates are presented in Table V-3, which for underground miners is similar to Table 28 in the final QRA and Table V-1 above.

¹⁹ Due to the non-linear nature of some of the risk models, MSHA determined that it was more appropriate to divide the projected risk under the final rule by the appropriate adjustment factor rather than multiply the risk under the current rule by the factor. The former resulted in a smaller absolute adjustment than the latter would have.

Table V-3: Estimated Reduction in Risk (Defined as Adverse Health Effects at Age 73 per 1,000 Exposed Miners with 45-Year Post-Finalization Working Lifetimes), by Underground Mining Occupation, from the Final Rule Lowering the Limit from 2.0 mg/m³ to 1.5 mg/m³, Basing Determinations of Compliance on MSHA's Single Samples and Revising the Definition of Normal Production Shift

Occupation	CWP 1+	CWP 2+	PMF	Severe Emphysema	Deaths from NMRD
Auger Operator	37.7	29.3	19.2	16.5	1.7
Continuous Miner Operator	59.3	48.0	32.2	24.5	2.7
Cutting Machine Operator	90.2	85.8	26.7	31.9	3.9
Drill Operator	27.3	20.3	14.3	10.6	1.3
Electrician & Helper	11.9	7.9	4.4	4.7	0.8
Laborer	10.5	7.4	4.4	4.3	4.0
Loading Machine Operator	6.1	4.0	2.7	2.5	1.0
LW Headgate Operator	33.0	25.7	16.4	13.9	1.6
LW Jacksetter	41.6	33.6	22.3	17.6	2.1
LW Tailgate Operator	60.2	53.7	38.5	22.8	2.7
Mechanic & Helper	16.5	11.1	7.3	7.4	1.2
Mobile Bridge Operator	31.1	28.2	18.8	15.7	2.2
Roof Bolter	30.5	22.1	14.8	13.6	1.6
Scoop Car Operator	23.7	17.2	10.8	7.7	1.1
Section Foreman	13.8	9.5	5.9	9.2	1.5
Shuttle Car Operator	24.8	17.2	10.8	9.8	1.9
Uni-Hauler Operator	26.4	18.7	12.1	10.2	2.6
Utility Man	26.6	18.5	11.0	12.8	1.7
All Other Underground Jobs	30.0	24.9	18.4	12.4	2.7
Source: MSHA Computations					

The estimated benefits of all three provisions of the final rule²⁰ are presented in Table V-4.

²⁰ Based on the estimates in Table V-2 for surface and Part 90 miners, and the estimates in Table V-3 multiplied by the employment estimates in Table V-2 for underground miners.

Table V-4: Estimated Number of Adverse Health Effects Prevented, as of Age 73, 45-year Post Finalization Working Lifetimes, from Three Provisions of the Final Rule (Lowering the Limit from 2.0 mg/m³ to 1.5 mg/m³, Basing Noncompliance on a Single MSHA Inspector Sample, and the Revised Definition of Normal Production Shift)

Miner	CWP 1+	CWP 2+	PMF	Severe Emphysema	Deaths from NMRD
Underground and Part 90	826	626	417	350	62
Surface	42	29	16	24	3
Total*	869	655	433	374	65

* Totals may not add due to rounding

ESTIMATED MONETIZED VALUE OF FATALITIES AND ILLNESSES PREVENTED

Economists and health scientists have developed a variety of approaches for estimating the monetary value of avoiding adverse health effects. Some are more appropriate than others as a basis for cost-benefit analysis. To estimate the monetary values of the reductions in cases of CWP 1+, CWP 2+, PMF, severe emphysema, and deaths from NMRD for the proposed rule, MSHA analyzed the imputed value of illnesses and fatalities avoided based on a willingness-to-pay approach. In the final rule, MSHA continues to use the willingness-to-pay approach to estimate the Agency's preferred dollar values of disease and death. However, in the final rule, MSHA estimated benefits using a range of disease values.

For the proposed rule, MSHA monetized the reduction in the number of deaths from NMRD using a study by Viscusi and Aldy (2003). MSHA retained this approach for the final rule. Viscusi and Aldy (2003) conducted an analysis of studies that use a willingness-to-pay approach to estimate the imputed value of life-saving programs (i.e., meta-analysis) and found that each fatality avoided was valued at approximately \$7 million and each lost work-day injury was valued at approximately \$50,000 in 2000 dollars. Using the GDP Deflator (U.S. Bureau of Economic Analysis, 2010), the inflation-adjusted estimates are \$8.7 million for each fatality avoided in 2010 dollars. This value of a statistical life (VSL) estimate is within the range of the majority of estimates in the literature (\$1 million to \$10 million per statistical life), as discussed in OMB Circular A-4 (OMB, 2003).

MSHA emphasizes that, although VSL is a useful statistical concept for monetizing benefits, it does not represent the value of a life. Rather, it represents a measurement related to risk reduction so that various options can be compared.

For the proposed rule, MSHA used two separate values to monetize the value of the diseases prevented. The Viscusi & Aldy (2003) analysis valued each lost work-day injury at approximately \$50,000 in 2000 dollars. MSHA used this estimate of \$62,000 after adjusting for inflation in 2009 dollars for each case of CWP 1+ or CWP 2+ prevented. Given the disabling consequences of PMF and severe emphysema, MSHA did not believe that limiting the value to the estimate for lost workday injuries was appropriate. Instead, MSHA based the value of a case of PMF and severe emphysema prevented on the work of Magat, Viscusi & Huber (1996), which estimated the value of a non-fatal cancer avoided. The Occupational Safety and Health

Administration (OSHA) used this approach in the Final Economic Analysis (FEA) supporting its hexavalent chromium final rule, and the Environmental Protection Agency (EPA) used this approach in its Stage 2 Disinfectants and Disinfection Byproducts water rule (EPA, 2003). MSHA believed that PMF and severe emphysema have a similar impact on the quality of life and would result in similar valuations. Based on Magat, Viscusi & Huber (1996), EPA valued the prevention of a case of nonfatal cancer at 58.3 percent of the value of a fatal cancer avoided.

For the final rule, MSHA developed a range of dollar values for pneumoconiosis (CWP 1+ and CWP 2+), PMF and severe emphysema. To estimate the range of monetary values of the reductions in cases of CWP 1+, CWP 2+, PMF, and severe emphysema, MSHA also examined approaches other Federal regulatory agencies have taken in the past for similar regulatory actions. Based on this research, MSHA concluded that willingness-to-pay and cost-of-illness methods were applicable to this analysis.

Willingness to pay is the preferred methodology for cost benefit analysis because it is the best fit with economic theory and consumer choice. In one possible approach to estimating WTP, researchers determine the estimate by asking individuals how much they would be willing to pay to avoid, for example, a case of nerve disease, versus how much they would be willing to pay to avoid another type of risk such as an automobile fatality. Then the researcher multiplies the relative risk by the dollar value that the individual places on avoiding the second type of risk, in order to derive a dollar value for the individual's willingness to pay for avoiding the first risk. Averaging these preferences over a large number of respondents reduces the effects of differences in age and other factors between individuals. Another willingness-to-pay approach is based on the theory of compensating wage differentials (i.e., the wage premium paid to workers to accept the risk associated with various jobs) in the labor market. A number of studies have shown a correlation between higher job risk and higher wages, suggesting that employees demand monetary compensation in return for incurring a greater risk of illness or fatality.

Use of existing willingness to pay research in cost-benefit analyses may be characterized by issues related to transferability (for example, estimates generated for other populations may not be optimal for coal miners). Another approach to placing a value on avoiding adverse health effects is to calculate the direct and indirect costs of illnesses (COI). Numerous research efforts have concluded that cost-of-illness estimates are usually lower than a willingness-to-pay estimate and have a number of economic shortcomings, which must be considered when using these methods. Cost-of-illness estimates typically include medical care, hospital and nursing home care, pharmaceuticals, medical equipment, and lost productivity of ill persons and of family members caring for them. There may also be taxes foregone and possible payments for sick leave and welfare payments. Costs other than the direct medical costs are extremely difficult to calculate.

MSHA used willingness-to-pay estimates for the Agency's primary and a very simplified cost-of-illness approach only to establish ranges for values not directly transferable from willingness-to-pay studies. The cost-of-illness studies allowed MSHA to establish ranges of values not available in the willingness-to-pay studies.

Coal Workers' Pneumoconiosis

Coal workers' pneumoconiosis (CWP) occurs in two forms, simple and complicated. If further exposure to respirable coal mine dust is prevented, progression to more serious forms of pneumoconiosis may be avoided. However with continued exposure, miners with simple pneumoconiosis can develop the complicated form of the disease - progressive massive fibrosis (PMF). Complicated forms of the pneumoconiosis may also lead to severe emphysema. Simple CWP does not produce a disability or shorten life; however, PMF and severe emphysema are disabling. With PMF, premature death is associated with pulmonary disability.

The QRA for the final rule describes respirable coal mine dust exposure distributions for miners in various occupational categories. MSHA's QRA shows that exposures at existing levels can lead to material impairments of a miner's health or functional capacity. The QRA defines material impairments as CWP, chronic obstructive pulmonary disease (COPD), and death due to non-malignant respiratory disease (NMRD). The QRA notes that CWP has long been recognized as a progressive disease, and miners progressing to the PMF stage qualify as totally disabled due to pneumoconiosis under the Department of Labor's criteria in 20 CFR 718.304(a). The QRA also notes that COPD, which includes emphysema, is characterized by a significant loss of respiratory function and qualifies as material impairment under the Mine Act.

Value of Avoiding Simple Coal Workers' Pneumoconiosis

Under the final rule, MSHA is estimating separate dollar values for the two categories of simple pneumoconiosis, CWP 1+ and CWP 2+. MSHA makes this distinction because many miners with CWP 1+ may not exhibit symptoms, demonstrate a reduction in lung function, or the disease may not be detectable by a chest x-ray. Although many miners may not exhibit symptoms in early pneumoconiosis, some miners will have increased illnesses and lost workdays attributable to CWP even though CWP has not been diagnosed. A miner diagnosed with CWP 2+ may report symptoms, such as chronic cough, phlegm production, wheezing and shortness of breath, symptoms similar to that of chronic bronchitis, and may have a chest x-ray that shows lung abnormalities.

Coal Workers' Pneumoconiosis, CWP 1+

For the proposed rule, MSHA monetized the reduction in cases of CWP 1+ and CWP 2+ using the study by Viscusi and Aldy (2003) that valued each lost work-day injury at approximately \$50,000 in 2000 dollars. Using the GDP deflator, the inflation-adjusted estimate was \$62,000 for each injury avoided in 2010 dollars.

In the final rule, MSHA's preferred dollar value for avoiding a case of CWP 1+ continues to be based on the Viscusi and Aldy (2003) lost-time injury willingness-to-pay estimate used in the proposed rule. For CWP 1+, MSHA examined several cost-of-illness studies and concluded that average medical cost drivers such as physician visits and hospitalization were an acceptable starting point for calculating a new cost-of-illness estimate. MSHA used the 2003 Miravittles study's average number of medical appointments as a reference. MSHA used the 2011 HHS Medical Expenditure Panel Survey (MEPS) data for individuals aged 18 to 65 (adjusted with the chained medical CPI) to estimate the cost per visit per year. MSHA converted the annual cost to a per case cost by multiplying the number of years related to the disease severity and progression

times the MEPS costs. Based on Blanchette et al. (2008), MSHA priced prescription costs at 5.7 percent of other medical costs.

Table V-5 presents MSHA's adjustments to the data to calculate the lower range value for CWP 1+ and Table V-6 presents MSHA's adjustments to the data to calculate the upper range value for CWP 1+.

Table V-5: CWP 1+ Monetization, Low Value

	visits	MEPS 2010 Inflation Adjusted	Treatment CWP 1+ Low	Dollars CWP 1+ Low
GP Visit	5.1	\$1,136	1	\$1,136
Chest Specialist	1	\$1,206	1	\$1,206
ER	0.5	\$1,682	0	\$0
Hospitalizations	0.2	\$16,975	0	\$0
Medical Subtotal				\$2,342
Rx percent of total Other Medical (Blanchette, et al., 2008)		5.7%		\$133
Annual cost				\$2,475
10 years, Rounded				\$25,000

Table V-6: CWP 1+ Monetization, High Value

	visits	MEPS 2010 Inflation Adjusted	Treatment CWP 1+ High	Dollars CWP 1+ High
GP Visit	5.1	\$1,136	5.1	\$5,792
Chest Specialist	1	\$1,206	1	\$1,206
ER	0.5	\$1,682	0.5	\$841
Hospitalizations	0.2	\$16,975	0	\$0
Medical Subtotal				\$7,840
Rx percent of total Other Medical (Blanchette, et al., 2008)		5.7%		\$447
Annual cost				\$8,287
30 years, Rounded				\$250,000

Coal Workers' Pneumoconiosis, CWP 2+

MSHA's preferred value for avoiding a case of CWP 2+ is \$431,000. The value for CWP 2+ is based on an Environmental Protection Agency (EPA) final rule that estimated an avoided case of chronic bronchitis at \$410,000 in 2007 dollars²¹. MSHA revised the Agency's preferred dollar values for CWP 2+ after reviewing literature, considering EPA's assumption that the cases due to environmental causes were less severe than occupational sources, and

²⁰U.S. EPA Office of Air and Radiation, "Regulatory Impact Analysis for the Federal Implementation Plans to Reduce Interstate Transport of Fine Particulate Matter and Ozone in 27 States; Correction of SIP Approvals for 22 States," June 2011, <http://www.epa.gov/airtransport/pdfs/FinalRIA.pdf>.

determining that CWP 2+ and chronic bronchitis are similar. These diseases are similar in that, at early stages, they cause minimal damage to lung tissue, and if further exposure is prevented, progression to more serious forms of disease may be avoided. Like chronic , CWP 2+, while a material impairment of health, is not disabling. Additionally, the EPA value is the result of modeling uncertainty around the pollution, the population distribution, timing, and income elasticity.

For the lowest value of CWP 2+ (\$150,000), MSHA applied the same methodology described for CWP 1+ but with a different number of treatments and a 20-year period. Table V-7 presents the monetized low value of CWP 2+.

MSHA highest value for CWP 2+ is based on the value of chronic bronchitis (\$.588 million) from EPA Stage 2 Disinfectants and Disinfection Byproducts Water rule in 2003 million adjusted for inflation to \$0.76 million.

Table V-7: CWP 2+ Monetization, Low Value

	visits	MEPS 2010 Inflation Adjusted	Treatment CWP 2+ Low	Dollars CWP 2+ Low
GP Visit	5.1	\$1,136	5.1	\$5,792
Chest Specialist	1	\$1,206	1	\$1,206
ER	0.5	\$1,682	0	\$0
Hospitalizations	0.2	\$16,975	0	\$0
Medical Subtotal				\$6,998
Rx percent of total Other Medical (Blanchette, et al, 2008)		5.7%		\$399
Annual cost				\$7,397
20 years, Rounded				\$150,000

Value of Avoiding PMF and Severe Emphysema

As noted in the QRA, miners with PMF qualify as being presumptively totally disabled under the Department of Labor criteria in 20 CFR 718.304(a). The Social Security Administration (SSA) also recognizes PMF as a presumptively disabling condition (<http://www.ssa.gov>). Miners with PMF are unable to work.

PMF is identified on chest x-rays by large lesions (nodular masses) greater than 1 cm in diameter and often multiple and bilateral, represent coalescence of smaller nodules. Disability is caused by destruction of lung tissue that is incorporated into the nodules (Rubin's Pathology, 2011). As PMF worsens, adjacent lung tissue retracts towards the lesions, typically in the upper airways. Alveoli and blood vessels are destroyed and airways become distorted and inflexible as lung function is lost (Wade, 2011). PMF causes a mixed obstructive and restrictive lung function pattern. Distortion of the airways results in irreversible obstructive changes; the large masses of fibrous tissue reduce the useful volume of the lung. Abnormally low concentration of oxygen in the blood (hypoxemia), pulmonary heart disease (cor pulmonale), and terminal respiratory failure may occur in persons with PMF (Lyons and Campbell, 1981; Attfield and Wagner, 1992; Miller and Jacobsen, 1985; West, 2011). The NIOSH Respiratory Disease

Research Program documented that PMF is a disabling and life-threatening condition (NIOSH, 2007; Castranova and Vallyathan, 2000). PMF is progressive, totally disabling, and incurable, and causes premature death.

Severe emphysema also is progressive, disabling, and incurable, and causes premature death (<http://www.nhlbi.nih.gov>, <http://www.ssa.gov>). The QRA characterizes severe emphysema as a disabling loss of respiratory function. Miners with severe emphysema are unable to work. NIOSH defines a severe and disabling decrement in lung function as a FEV₁ of less than 65 percent of expected normal values. A person with severe emphysema will have a lung function, as measured by FEV₁, numbers for severe emphysema reveal between 49 and 30 percent of normal lung function (FEV₁/FVC <49-30 percent).

According to the National Heart, Lung, and Blood Institute, HHS (<http://www.nhlbi.nih.gov>), although emphysema develops slowly, a person's symptoms often worsen over time and can impair the ability to perform any normal daily activity. Flare-ups (exacerbations) from the disease become more frequent. These flare-ups can become increasingly serious, even deadly, with FEV₁ numbers during these episodes revealing less than 30 percent of normal lung function (FEV₁/FVC <30 percent). Respiratory failure can occur, which may also lead to effects on the heart such as right heart failure (cor pulmonale).

For the final rule, MSHA reviewed the work of Magat, Viscusi and Huber (1996), which measured willingness-to-pay values for reducing the probability of contracting nerve disease (peripheral neuropathy) and two forms of lymphoma (cancer of the lymph system). This study found that the median amount persons would be willing to pay to avoid nerve disease was 40 percent of what they would pay to avoid death in a car crash, and was 58.3 percent to avoid non-fatal lymphoma.

MSHA also reviewed the work of Viscusi, Magat, and Huber (1991). This earlier study laid the groundwork for the methodology used in Magat et al. (1996). Viscusi et al. (1991) measured a willingness-to-pay value for reducing the probability of contracting chronic bronchitis. The study found that the median amount persons would be willing to pay to avoid chronic bronchitis was 32 percent of what they would pay to avoid death in a car crash, although it found that the mean (average) amount was 68 percent

In developing the estimates for the final rule, MSHA used both Viscusi et al. 1991 and Magat et al. 1996, although MSHA believes that the willingness-to-pay values in the Magat et al. 1996 study are more closely related to those for PMF and severe emphysema. MSHA reevaluated the diseases in the Magat et al. (1996) study and determined that peripheral neuropathy (nerve disease) is a disabling disease like PMF and severe emphysema and causes a more comparable degree of disability than curable lymphoma.

The health consequences of nerve disease as described in this study include, among other things, weakness, inability to move, constant pain, depression, inability to work. Nerve disease also is incurable. These health consequences of nerve disease, as described, are similar to the health effects of PMF and severe emphysema discussed above. One difference is that the end point of PMF and severe emphysema is the probability of premature death; the authors stated that nerve disease "is nonfatal in most cases." For this reason, it is possible that subjects may be willing to pay more to avoid PMF and severe emphysema than to avoid nerve disease.

Viscusi et al. (1991), on the other hand, measured a willingness-to-pay value for reducing the probability of contracting chronic bronchitis. Although chronic bronchitis is a respiratory disease, it is a fundamentally different disease than PMF or severe emphysema in terms of health effects. Generally, chronic bronchitis does not progress if exposure is halted. The health implications listed by Viscusi et al. (1991), while serious, are not totally disabling. Early diagnosis and treatment can improve a person's quality of life (<http://www.nhlbi.nih.gov>). Chronic bronchitis may or may not cause airway obstruction such as scarring or destruction of lung tissue. The health implications of chronic bronchitis identified by Viscusi et al. (1991) also did not include premature death, a well-known outcome of PMF and severe emphysema. For these reasons MSHA concluded that the symptoms expressed in Magat et al. (1996) are more comparable to the disabling consequences and long-term health effects of PMF and severe emphysema.

The authors in Viscusi et al. 1991 stated that due to the need for further research into the potential biases of their method, "much further research is needed before applying the methodology to give estimates precise enough to be used in regulatory analyses." Specifically, the authors identified that sensitivity analyses was needed to determine the degree of familiarity persons must have with the health benefit being valued. The authors in Magat et al. 1996 stated that their methodology was limited and only valued one form of nerve disease and two forms of lymphoma. The authors stated that "specific results for nerve disease and lymphoma cannot be directly used for the valuation of other diseases." Moreover, although they described their 1991 study as "elicit[ing] values for avoiding short term health risks", their 1991 study described itself as focusing on "the most severe chronic morbidity effects" of chronic bronchitis".

MSHA evaluated both studies and for its benefit calculation and concluded that the value of avoiding PMF and severe emphysema is in a range between the low estimate \$2.8 million (32 percent of VSL, Viscusi et al. 1991) and high estimate of \$3.5 million (40 percent of VSL, Magat et al. 1996); thus, MSHA chose (36 percent), the average of the two, for the Agency's preferred value for PMF and severe emphysema. Using this approach, the value for avoiding a case of PMF or severe emphysema is \$3.15 million (36.0 percent of \$8.7 million) for a total estimated value of \$2.5 billion. This is an appropriate approach in estimating the value of avoiding PMF and severe emphysema given the methodological limitations of both studies.

Total Value of Adverse Effect Prevented

MSHA developed the estimates in Table V-8 by multiplying the number of adverse health effects prevented in Tables V-2 and V-3 by the preferred monetized value of each adverse health effect. For example, the \$221.5 million estimate in Table V-8 for total deaths from NMRD based on 2 provisions was calculated by multiplying the 25.5 deaths prevented from Table V-2 by the \$8.7 million per death prevented.²²

The total estimated value of adverse health effects is \$3.4 billion dollars. These benefits will not be fully realized until all the currently employed miners are replaced by miners who have not previously been exposed to respirable coal mine dust. Table V-8 reflects MSHA's analysis that started with the 2 provisions from the QRA for the final rule and then the results of the analysis with the additional provision.

²² Estimates presented in Table V-8 may differ slightly from estimates based on the numbers presented in Tables V-2 and V-3 due to rounding.

Table V-8: Estimated Value of Adverse Health Effects Prevented, as of Age 73, 45-Year Post-Finalization Working Lifetimes (Millions of 2010 Dollars)*

	CWP 1+	CWP 2+	PMF	Severe Emphysema	Deaths from NMRD	Total
Benefits Based On Table V-2 (i.e., based on the two provisions in the QRA for the final rule)						
Underground and Part 90 Miners	\$34.1	\$191.1	\$953.2	\$707.4	\$196.8	\$2,082.6
Surface Miners	\$2.6	\$12.5	\$50.2	\$74.8	\$24.8	\$164.9
Total	\$36.8	\$203.7	\$1,003.4	\$782.2	\$221.5	\$2,247.5
Benefits Based On Table V-4 (i.e. includes an additional provision extrapolated from QRA results for the final rule)						
Underground and Part 90 Miners	\$51.2	\$269.9	\$1,312.7	\$1,103.0	\$538.8	\$3,275.7
Surface Miners	\$2.6	\$12.5	\$50.2	\$74.8	\$24.8	\$164.9
Total	\$53.9	\$282.4	\$1,362.9	\$1,177.8	\$563.6	\$3,440.6

* Rounding may affect totals

SUMMARY OF LIMITATIONS AND ASSUMPTIONS

In the preamble to the proposed rule, MSHA noted several limitations of the benefits analysis in the Preliminary Regulatory Economic Analysis (PREA). The benefits analysis in the PREA was based on the QRA for the proposed rule. As a result of comments received on the QRA for the proposed rule and discussed in Section III.B. of the preamble, MSHA revised the QRA for the final rule as follows.

- The QRA for the proposed rule did not account for uncertainties related to sampling error or the assumption that single-shift exposures currently above the proposed limits of 1.0 mg/m³ (or 0.5 mg/m³ for part 90 miners) would be reduced no further than necessary to achieve compliance with the proposed limits on each shift. MSHA's QRA for the final rule contains an analysis of uncertainty with respect to sampling error and a sensitivity analysis of MSHA's exposure estimates.
- MSHA's QRA for the proposed rule did not account for measures that operators may take to avoid having exposures on any shift exceed the proposed standard. The QRA for the final rule uses expected reduction factors to project the impact that the final rule will have on exposures at or below 1.5 mg/m³, or 0.5 mg/m³ for part 90 miners.

Some limitations in the benefits analysis in the REA may result in underestimating the benefits for the final rule.

- MSHA does not have data or quantitative models to quantify the benefits associated with several provisions of the final rule (e.g., full-shift sampling, quarterly sampling of designated occupations (DOs), other designated occupations (ODOs), and part 90 miners using the CPDM; periodic medical surveillance examinations; and extending the part 90 option to surface coal miners). The Agency expects that these provisions will reduce the respirable dust levels and further protect miners from the debilitating effects of occupational respiratory disease. If the required data and quantitative models were available, MSHA believes that the combined effect of these provisions, particularly the requirements for full-shift sampling, and requiring more frequent sampling of selected occupations and locations using the CPDM would result in additional risk reductions

beyond those projected in Table 28 of the QRA as well as an increase in the quantified benefits reported in this document.

- As shown in Table 28 of the QRA for the final rule, since MSHA does not have data on the smoking status of the mining population specific to occupation and work location, the Agency assumed that all miners were non-smokers when calculating the number of cases of severe emphysema that would be reduced. Overall, Kuempel et al. (2009a) established that exposure to coal mine dust can produce clinically important levels of emphysema in coal miners regardless of smoking status. Furthermore, Attfield and Seixas (1995) tested the effects of smoking and CWP incidence and found that smoking contributed substantially less to the incidence of disease than age.
- In the REA, MSHA estimated the number of adverse health effects prevented by multiplying the estimated risk reductions presented in Table 28 of the QRA for the final rule by the current number of coal miners in each occupation estimated to be directly involved in or near operations that generate respirable coal mine dust. However, because MSHA does not have the racial composition of the mining population specific to occupation and work location, the Agency applied the risk factor for whites to all miners when calculating the number of cases of severe emphysema that would be prevented. Results are summarized in Table V-2 of the REA. On average, benefits would be underestimated for non-whites because the reduction in excess risk for non-whites is greater for 17 of the 19 underground occupations, part 90 miners, and 11 of the 14 surface occupations (See Table 28 of the QRA).

On the other hand, in both the PREA and this evaluation, MSHA assumed a 45-year working life which may yield larger estimates of the number of cases of pneumoconiosis and possibly overestimate the benefits for the final rule. MSHA's longstanding practice to use a 45-year working life assumption for health standards is not based on empirical data that most miners are exposed to respirable coal mine dust for 45 years. Rather, it is based on the Mine Act's statutory directive that no miner suffers material impairment of health or functional capacity even if such miner is exposed to the hazard for the period of his or her working life. To the extent that miners' careers are shorter than 45 years, the actual benefits may be lower.

The Agency further notes that there has been a downward trend over time (including between 2008—the last year reflected in the QRA—and 2012—the most recent year for which data are available) in miners' dust exposure. To the extent that dust exposure is trending downward, the trend may have a downward effect on the impact of the rule. However, any result needs to be interpreted with caution due to data limitations—including only 6 percent of shifts being represented in the data set and aggregation across occupations having the potential to obscure upward trends for certain sub-groups of miners.

ESTIMATING BENEFITS OVER TIME

To compare the estimate of benefits with the estimate of costs, it is necessary to project the timing of the benefits. Occupational risk assessments are generally designed to estimate the risk of an occupation related illness over the course of an individual worker's lifetime. The estimate of benefits is calculated by comparing the number of cases of illness and death expected to occur at the existing standard of 2.0 mg/m^3 to the projected number of cases of illness and

death at the final dust standard of 1.5 mg/m^3 . MSHA's QRA for the final rule presents the estimated reduction by occupation in the number of cases of illness and death per 1,000 workers that would occur from reducing current exposures above 1.5 mg/m^3 to 1.5 mg/m^3 . These estimates were then multiplied by 2009 employment estimates to project the number of cases of illness and death that would be prevented by the final rule for miners and ex-miners at age 73 with 45-year working lifetimes beginning after rule finalization. To annualize the benefits for the period of time after the final rule takes effect, it is necessary to create a timeline of benefits for an entire active workforce over that period.

While there are various approaches that could be taken for modeling the workforce, there are two extremes. At one extreme, one could assume that none of the benefits occur until after the current workforce retires. Under this approach, workers with minimal cumulative exposure (both in terms of years of exposure and levels of exposure) would be assumed not to benefit from the revised standard. At the other extreme, one could assume that the benefits occur immediately. Based on the various risk models, which reflect real-world experience with development of disease over an extended period, neither extreme approach is appropriate.

For the proposed rule, MSHA projected the timing of the benefits for miners hired after rule finalization under two alternative assumptions to illustrate some of the uncertainty in its estimates. First, MSHA made the assumption that benefits begin immediately and that annual benefits equal lifetime benefits divided by 45 years. This assumption is equivalent to assuming that the benefits begin to accrue in the first year after the provisions are put into effect. However, dividing estimated benefits over a working lifetime of 45 years by 45 years provides a benchmark from which the other models can be compared because once the impacts of employee turnover and the progression of adverse outcomes are fully accounted for, the annual benefit should equal this benchmark. MSHA's alternative approach for the proposal was to assume that no benefits would occur for the first 10 years and that the annualized benefit for each of the next 35 years would be equal to the projected benefits divided by 35 years. Under this approach, the annual benefits in years 11 through 45 were assumed to be 29 percent higher than the benchmark $1/45^{\text{th}}$ of the 45-year lifetime benefits, and it would take 45 years to reach the benefits calculated for the 45-year working lifetime.

MSHA received several comments on the Agency's proposed approach. For example, a commenter stated that the PREA does not generally provide information showing the timing of costs and benefits or the net present value once future values are discounted. The commenter further stated that the timing of the estimates of costs and benefits is important because the large costs are near term and, therefore, they are more certain. In addition, the benefits are not expected to be evident until a substantial portion of the current workforce has retired –and, therefore, they are more uncertain. The commenter also stated the time frame of the analysis in the PREA is vaguely defined because the costs appear to be placed in no more than a ten-year time frame, and the benefits are measured after 45 years of reduced exposure levels. The commenter presented a report showing that there are large differences in the stream of costs and benefits over time. The commenter suggested that the comparison of costs and benefits should be made with the understanding that annual costs are immediately and realistically incurred while the annual benefits in the PREA are manipulations of the benefits that might be realized after 45 years.

In the PREA, MSHA stated that its estimates did not include the potential impacts of other provisions of the proposed rule. MSHA further stated that it did not have the data

necessary to calculate benefits to miners with historical exposures and pre-existing conditions or estimate how long it would be until the benefits of this rule begin to accrue.

One commenter suggested that data were available for MSHA to do further analysis than was presented in the PREA to address the estimated impacts for the existing miner population or to conduct a proper economic analysis of the estimated benefits of the proposed rule. The commenter further explained that the risk models that MSHA is using to measure the benefits based on its hypothetical worker cohorts can be applied to data on the existing labor force and new entrants over time.

The MSHA models estimate risks based on age of the worker and cumulative exposures, among other variables such as smoking and coal rank. With information about the living cohort populations in each future year by age, years since first exposure, and occupational category (to account for different exposure levels), these models can be applied to a realistic description of the actual work force. This type of analysis has been used routinely to estimate changes in occupational exposures to asbestos. It builds on the approach and data published by William J. Nicholson, George Perkel, and Irving Selikoff (1982), which is organized by industry.

The Nicholson approach is the generally accepted methodology used by experts to project future asbestos-related health effects from an exposed labor force. The Nicholson approach can be modified to reflect changes in the number of exposed workers by year, industry, exposure levels, and employment duration in specific cohorts, and it incorporates historical changes in hiring and exposure levels. Nicholson et al. collected workforce data from the Bureau of Labor Statistics (BLS), the Census, and labor unions in industries in which asbestos products were manufactured or used. Nicholson et al. then estimated the number of workers exposed to asbestos beginning in 1935 through 1979 for eleven categories of asbestos-related industries and occupations. From this estimate of occupational exposure to asbestos, Nicholson et al. projected the number of workers exposed and living in the years 1980 through 2045.

MSHA did not adopt the Nicholson approach because data are not available to characterize the current workforce both in terms of tenure and turnover. The BLS and Census data on mining are limited (e.g., there is no distinction between surface and underground mining) and because turnover rates alone cannot be used to accurately project previous exposure (e.g., there is a significant difference in previous exposures of new miners entering the industry and experienced miners changing employers). Moreover, MSHA's QRAs for the proposed and final rule stratified the existing workforce into over 30 occupation/work location combinations and 3 levels of coal rank (based on region). Workforce statistics for coal miners are simply not available anywhere near this level of detail.

Similar data issues were noted in a paper by Attfield et al. The authors stated that "Migration between the anthracite and bituminous regions may impact the findings for CWP. Due to the decline of the anthracite coal industry, it is possible that many anthracite workers migrated to the bituminous coal fields, their deaths there artificially inflating the number of bituminous deaths and likewise underestimating the number of anthracite deaths. Some migration in the opposite direction could have occurred, although it is likely to be less. It is not known to what extent migration took place, as information on the source of work exposures is not given on the death certificate.

The employment data used in the analysis of CWP for both regions includes both surface and underground coal miners (data giving only underground employment has so far not been

identified).”²³ The commenter’s use of Census data to estimate employment required the use of data for NAICS industry code 21 Mining, Quarrying and Oil and Gas Extraction rather than coal mining. The use of these data would not be appropriate since coal miners are a small subset of this larger group. Employment data are not available for subsets of NAICS industry code 212, “Mining (except Oil and Gas)”.

Moreover, to calculate the health effects for each group, data on an individual miner’s age (necessary for the use of life tables) and exposure are necessary. Since these data are not available, the Nicholson approach would require making a series of assumptions. These assumptions would affect the results, as it makes a difference (due to the life tables) whether an older worker is replaced by a younger worker or vice versa.

Based on the numerous comments and further examination of the modeling requirements, MSHA realized that attempting to provide more granularity with additional assumptions to the existing simple linear model was not appropriate. MSHA could not balance the need for a large number of assumptions, a shortage of relevant data, and the desire to make the estimate more realistic.

Considering a new approach required MSHA to consider whether a well-supported theoretical model was possible or whether a simpler approach such as the existing linear model could be replaced with a pattern that was merely a different functional form. MSHA examined a number of economic analyses of rules in the hope of finding one to emulate.

The Food Safety and Inspection Service of the US Department of Agriculture (USDA) faced a similar data sufficiency problem in estimating “...the differential effect of introducing an FSIS continuous catfish inspection program on the potential number of human Salmonella illnesses from farm-raised catfish consumption of each year.” When explaining how annual cases of Salmonella prevention could be estimated, the USDA used a simple explanation of why the binomial and Poisson distributions were applicable. (Risk Assessment of the Potential Human Health Effect of Applying Continuous Inspection to Catfish, July 2012, available http://www.fsis.usda.gov/wps/wcm/connect/80a428f3-43fb-4421-b97d-885909e5a228/Catfish_Risk_Assess_July2012.pdf?MOD=AJPERES, particularly pages 39-43). MSHA is not indicating that the analyses are the same, but rather that the decision about what probability distribution to use is similar.

The EPA uses a highly integrated process developed over decades of scientific research. The pollution modeling, dose-response functions, population data, and economic assumptions are integrated into a single structured model. Uncertainty analysis is applied to the model using probability distributions, such as a triangular distribution, in conjunction with statistical variance. Finally, many of the economic measures are outputs of this integrated modeling.

After examining several evaluations and background articles on benefits methodology, MSHA concluded that there were desirable concepts to emulate but they were not feasible because key data and analytical inputs are not available for coal mining health modeling. MSHA was not in a position to conduct a large-scale uncertainty analysis with a simulation tool but the

²³ M D Attfield, K M Bang, E L Petsonk, P L Schleiff, J M Mazurek; “Trends in pneumoconiosis mortality and morbidity for the United States, 1968-2005, and relationship with indicators of extent of exposure”; Journal of Physics: Conference Series 151 (2009) 012051; pg. 7-8.

concept of a probability distribution used in Monte Carlo simulation is applicable to the results of the QRA models. MSHA prefers to start with the function that represents the distribution of the population. The QRA was not designed to provide cumulative probabilities or functions for direct application of a probability distribution. For disease, the underlying risk reduction tables do represent a probability that was calculated based on data that represents a binary state of disease/not disease. The mortality calculation is similar but is a binary for premature death instead of disease.

MSHA considered a number of probability functions versus simply converting the pattern via an alternate functional form. In the field of insurance and disease treatment or prevention, several probability functions are used to address the binary nature of health treatments, outcomes, and risk of policy payout. The binomial distribution is one of the most common for binary variables as used to model with logit regressions. The Poisson distribution provides a simplification for binomial data as well as for data naturally Poisson distributed.

There are a number of reasons to use probability distributions for modeling under uncertainty. The first reason is to represent the uncertainty at any point in time but capture the overall likelihood of an outcome. The concept of expected value is the result of applying uncertainty over time to point estimates or a series of estimates from a deterministic model. Use of a cumulative probability distribution provides the full range of 0 to 100 over a specified time horizon. The method MSHA used does represent an expected value application.

In certain models of the impact of regulatory standard changes, equilibrium is reached at some point when the rate of change in the locked-in expected benefits reaches zero and the annual locked-in expected benefit becomes constant. For this rulemaking, that equilibrium point is 45 years. (Note that locked-in expected benefits are health and longevity improvements that are attributable to a particular year's exposure reductions but that may be primarily realized in the future.) The annual dollar value is the mean of the total divided by the number of years of equilibrium. For this rule, the calculation is \$3.4 billion/45 years or \$76.5 million/year. Some of the REA discussion describes this equilibrium point as steady state benchmark. For purposes of discussion, the terms are interchangeable.

The use of a single probability distribution to model the combined effects of employee turnover and the progression of disease and morbidity is a technique that has been employed by other federal agencies such as EPA. For example, in its "Health and Welfare Benefits Analyses to Support the Second Section 812 Benefit-Cost Analysis of the Clean Air Act Final Report, (February 2011), EPA combined the lag for the environment to recover from previous pollution and the latencies of the disease.

Based in part on prior Council HES advice, EPA has typically assumed that there is a time lag between changes in pollution exposures and the total realization of changes in health effects. Within the context of benefits analyses, this term is often referred to as "cessation lag". The existence of such a lag is important for the valuation of premature mortality incidence because economic theory suggests that benefits occurring in the future should be discounted. In this analysis, we apply a twenty-year distributed lag to PM mortality reduction. . . (p. 2-36).

EPA also used a similar approach (combining the lag for the environment to recover from previous pollution and the latencies of the disease into a single cessation lag) to estimate the benefits from reduced cancer incidence due to improved water quality resulting from coal fired

electric power generation (Regulatory Impact Analysis (RIA) for the final Transport Rule Docket ID No. EPA-HQ-OAR-2009-0491 available at <http://www.epa.gov/airtransport/pdfs/FinalRIA.pdf>). EPA applied an overall probability to determine duration (p.116) and a Poisson distribution to model pollution frequency over time (p.136). Therefore, MSHA believes that using a single function to project multiple effects is a reasonable approach.

MSHA based estimates of the net benefits of the final rule on a single probability distribution to account for both the expected latency of all adverse health outcomes and the turnover of the workforce. MSHA explored the use of several probability distributions and found that the cumulative Poisson distribution appears to fit the current problem quite well. The Poisson distribution is commonly used to model the number of events occurring within a given time interval. A significant practical advantage to using the Poisson distribution for the estimation of the benefit timing is that it is controlled by a single parameter, the mean. MSHA believes that it is reasonable to set the mean of the Poisson to 20 years to account for the lag of both the expected latency of all adverse health outcomes and the turnover of the workforce.

While the use of a single probability distribution to phase in the benefits resulting from the final rule cannot possibly provide a complete representation of the complex relationships among worker exposure, worker turnover and the progression of disease and illness, the cumulative Poisson distribution (with mean = 20) results in a reasonable approximation of MSHA's expected timing of the monetized benefits. In the first decade, few benefits will be realized because the workforce is predominantly composed of miners who were previously exposed to the higher dust levels under the existing standard without sufficient time for the lower dust standard to affect the rates of disease and illness. During the second and third decades, benefits will increase because the workforce is primarily comprised of miners exposed only to dust levels under the final rule or exposed to the existing standard for a relatively short period. In addition, during these decades sufficient time will pass for the benefits of the final rule to become evident despite disease latency. In the fourth decade, the benefits will reach to within rounding error of the steady state of 100%. MSHA recognizes that there is a likelihood that currently employed miners will derive some benefit from the final rule.²⁴

Under this approach, it would take 65 years to reach the benefits calculated for the 45- year working lifetime.²⁵ The probability based annual dollar calculation is merely the annual dollar benefit (\$76.5 million x percentage from the cumulative distribution).

The use of a probability distribution provides several advantages. First, it avoids the need to make the numerous assumptions that would be necessary to handle each effect separately. No explicit assumptions were made regarding workforce turnover or the lag of specific adverse health outcomes for either newly hired miners or for miners previously exposed to existing dust levels. In other words, MSHA is using the cumulative Poisson distribution to project the expected benefits by year without specifying which group of miners and adverse health outcomes avoided resulted in those benefits. Next, the probability distribution creates a smooth

²⁴ Generally, calculations indicate that the estimates appearing in Table V-11 may be consistent with an assumption that currently-working miners receive—on an undiscounted, per-exposure-reduction-year basis—70 to 90 percent of the benefits accruing to miners hired after rule finalization.

²⁵ Table V-9 shows percent of annual while Table V-10 shows that the total dollar benefit is reached at 65 years.

benefit stream rather than a discontinuous stream such as the one used for the proposal, where annual benefits abruptly jumped from zero to 1/35th of the total benefits in year 11.

Table V-9 presents the cumulative Poisson distribution with the mean set to 20 and the observation equal to the year minus 1.²⁶ The resulting distribution results in almost no benefits for the first decade (the percentage in year 11 is only 1 percent) and almost full benefits three decades out (the percentage in year 31 is 99 percent).

Table V-9: Cumulative Poisson Distribution with Mean = 20, By Year

Year	Percentage	Year	Percentage	Year	Percentage
1	0.0%	23	72.1%	45	100.0%
2	0.0%	24	78.7%	46	100.0%
3	0.0%	25	84.3%	47	100.0%
4	0.0%	26	88.8%	48	100.0%
5	0.0%	27	92.2%	49	100.0%
6	0.0%	28	94.8%	50	100.0%
7	0.0%	29	96.6%	51	100.0%
8	0.1%	30	97.8%	52	100.0%
9	0.2%	31	98.7%	53	100.0%
10	0.5%	32	99.2%	54	100.0%
11	1.1%	33	99.5%	55	100.0%
12	2.1%	34	99.7%	56	100.0%
13	3.9%	35	99.9%	57	100.0%
14	6.6%	36	99.9%	58	100.0%
15	10.5%	37	100.0%	59	100.0%
16	15.7%	38	100.0%	60	100.0%
17	22.1%	39	100.0%	61	100.0%
18	29.7%	40	100.0%	62	100.0%
19	38.1%	41	100.0%	63	100.0%
20	47.0%	42	100.0%	64	100.0%
21	55.9%	43	100.0%	65	100.0%
22	64.4%	44	100.0%		

Table V-10 presents the projected benefit stream over the 65-year analytical period, which was developed by multiplying the percentages in Table V-10 by the steady state annual benefit benchmark of \$76.5 million (\$3.4 billion based on 45-year working lifetime / 45 years).

²⁶ One was subtracted from the year to allow time for miners to experience the year of reduced dust exposure which results in the risk reduction.

Table V-10: Projected Monetized Benefits by Year
(Millions of Dollars)

Year	Benefit (\$ Millions)	Year	Benefit (\$ Millions)	Year	Benefit (\$ Millions)
1	\$0.0	23	\$55.1	45	\$76.5
2	\$0.0	24	\$60.2	46	\$76.5
3	\$0.0	25	\$64.5	47	\$76.5
4	\$0.0	26	\$67.9	48	\$76.5
5	\$0.0	27	\$70.5	49	\$76.5
6	\$0.0	28	\$72.4	50	\$76.5
7	\$0.0	29	\$73.8	51	\$76.5
8	\$0.1	30	\$74.8	52	\$76.5
9	\$0.2	31	\$75.4	53	\$76.5
10	\$0.4	32	\$75.8	54	\$76.5
11	\$0.8	33	\$76.1	55	\$76.5
12	\$1.6	34	\$76.3	56	\$76.5
13	\$3.0	35	\$76.3	57	\$76.5
14	\$5.1	36	\$76.4	58	\$76.5
15	\$8.0	37	\$76.4	59	\$76.5
16	\$12.0	38	\$76.4	60	\$76.5
17	\$16.9	39	\$76.4	61	\$76.5
18	\$22.7	40	\$76.5	62	\$76.5
19	\$29.2	41	\$76.5	63	\$76.5
20	\$36.0	42	\$76.5	64	\$76.5
21	\$42.7	43	\$76.5	65	\$76.5
22	\$49.2	44	\$76.5	Total over 65 yrs.	\$3,440.6

MSHA considered modeling independently for adverse health outcomes and employee turnover. Due to the lack of the underlying data needed to develop the models and the number of assumptions that would be necessary to overcome data limitations, MSHA is unable to disaggregate the effects of employee turnover from the progression of disease and morbidity.

- Data on coal miner turnover rates by occupation and coal rank is not available. Consistent with the assumptions made in the QRA, MSHA could assume that 1/45th of the workforce would turn over each year and that 65-year-old miners would be replaced by 20-year-old miners. However, MSHA determined that model was not appropriate for the epidemiology of respiratory disease among miners.
- If MSHA could develop miner turnover rates, MSHA would have to account for risk reduction for newly hired miners and for miners previously exposed under the existing dust standard. The QRA does not project the timing of the adverse health outcomes, so estimates for the progression of disease over time must be developed for both newly hired miners and for miners previously exposed to existing dust levels. NIOSH prevalence data cannot be directly applied because the QRA is based on the assumption that miners' exposure begins at age 20, which is not always the case for the miners in the prevalence data. MSHA has found that there are a limited number of studies that account for the

prevalence of pneumoconiosis (simple or complicated) among newly hired miners or younger miners.

- MSHA knows that miners exposed to dust levels under the existing standard will benefit under the final rule. However, it is difficult to project the timing due to the lag of the disease. Some miners already have respiratory illness. The lag for the disease and morbidity to manifest is less for existing miners than for new hires due to age and cumulative exposures. Models that account for timing of each adverse health outcome based on miners' age and cumulative exposure do not exist.
- Cumulative exposures are related to miner tenure. Risk reduction estimates for the existing workforce would have to be developed based upon tenure. This would substantially increase the number of categories that MSHA would have to analyze for the five adverse health outcomes and the 33 occupations working in three ranks of coal at age 73 (and age 85 for deaths from non-malignant respiratory disease (NMRD)). Risk projections for each occupation, rank and disease would have to be developed to reflect the differences in age and cumulative exposure of the existing workforce.

To summarize the benefit values presented in this chapter, Table V-11 presents the 65- year present value and annualized values for the low, preferred, and high benefit estimates with the discount rates of 0 percent, 3 percent, and 7 percent discounted over 65 and 45 years. The primary estimate values are also shown in the year by year tables (III-3, III-4, and III-5). Due to rounding in this table some values vary in the last decimal place.

Table V-11: Benefit Range and Discount Rates
(Millions of Dollars)

Benefit Range	Undiscounted	3 Percent Discount Rate	7 Percent Discount Rate
Low			
Present Value	\$2,942.0	\$898.0	\$240.9
Annualized, 65 Years	\$45.3	\$31.6	\$17.1
Annualized, 45 Years	\$65.4	\$36.6	\$17.7
Preferred			
Present Value	\$3,440.6	\$1,050.2	\$281.7
Annualized, 65 Years	\$52.9	\$36.9	\$20.0
Annualized, 45 Years	\$76.5	\$42.8	\$20.7
High			
Present Value	\$4,101.9	\$1,252.0	\$335.9
Annualized, 65 Years	\$63.1	\$44.0	\$23.8
Annualized, 45 Years	\$91.2	\$51.1	\$24.7

VI. REGULATORY FLEXIBILITY CERTIFICATION

INTRODUCTION

Under the Regulatory Flexibility Act (RFA) of 1980, as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA), MSHA has analyzed the compliance cost impact of the final rule on small entities. Based on that analysis, MSHA certifies that the final rule will not have a significant economic impact on a substantial number of small entities in terms of compliance costs. The factual basis for this certification is presented below.

DEFINITION OF A SMALL MINE

Under the RFA, in analyzing the impact of a rule on small entities, MSHA must use the Small Business Administration's (SBA's) definition for a small entity, or after consultation with the SBA Office of Advocacy, establish an alternative definition for the mining industry by publishing that definition in the Federal Register for notice and comment. MSHA has not established an alternative definition, and is required to use SBA's definition. The SBA defines a small entity in the mining industry as an establishment with 500 or fewer employees. There are 412 underground coal mines and 1,119 surface coal mines that meet the SBA definition.

MSHA has also examined the impact of the final rule on mines with fewer than 20 employees, which MSHA and the mining community have traditionally referred to as "small mines." There are 81 underground coal mines and 620 surface coal mines that meet this criterion as a small mine. These small mines differ from larger mines not only in the number of employees, but also in economies of scale in material produced, in the type and amount of production equipment, and in supply inventory. Therefore, the impact of the final rule on small mines and the related costs of compliance will also tend to be different.

One commenter on the proposed rule stated that operators of underground anthracite coal mines should be excluded from the proposal because respirable coal mine dust is not a problem in these mines under the existing standards. Also, the commenter noted that conditions in underground anthracite coal mines are different from those in the rest of underground non-anthracite coal mines. In response to the commenter's concerns, final § 70.201(j) states that "an anthracite mine using the full box, open breast, or slant breast mining method may use either a CPDM or a CMDPSU to conduct the required sampling." As a result, MSHA excluded CPDM-related costs for mines affected by final § 70.201(j) and compared the remaining costs of the final rule for these underground anthracite mines to their revenues.

This analysis complies with the requirements of the RFA for an analysis of the impact on "small entities", examines MSHA's traditional definition of "small mines", and addresses the impact of the final rule on underground anthracite coal mines.

FACTUAL BASIS FOR CERTIFICATION

General Approach

MSHA's analysis of the economic impact on small entities begins with a "screening" analysis. The screening analysis compares the estimates of annualized costs of the final rule for small entities to estimates of annual revenue. When estimated costs are less than one percent of estimated revenues for small entities, MSHA believes it is generally appropriate to conclude that the final rule will not have a significant economic impact on a substantial number of small entities. If estimated costs are equal to or exceed one percent of revenue, MSHA investigates whether further analysis is required.

Derivation of Costs and Revenues for Mines

The compliance costs noted in this chapter were previously presented in Chapter IV of this document along with an explanation of how they were derived and the cost impact on mines, by size. Revenue for underground and surface coal mines is derived from data on coal prices and tonnage. The 2010 price of coal was \$60.73 per ton for all underground coal mines, \$59.51 per ton for anthracite coal mines, and \$24.13 per ton for surface coal.²⁷

Throughout the economic evaluation, MSHA used 2009 mine production to remain consistent with the data used for the analysis of the benefits in Chapters III and V of this REA. Coal pricing for 2010 was used for the estimates below to be consistent with wage rates and compliance costs used in Chapter IV. Overall coal production tonnage did not vary significantly from 2009 to 2010.

Underground Coal Mines

Total underground coal production in 2009 was approximately 241.6 million tons for mines with 1-500 employees. Multiplying the tonnage by the 2010 price per ton generates underground coal revenue of \$14.67 billion for mines with 1-500 employees.

Total underground coal production in 2009 was approximately 5.036 million tons for mines with 1-19 employees. Multiplying the tonnage by the 2010 price per ton generates underground coal revenue of \$305.8 million for mines with 1-19 employees (including anthracite mines affected by final § 70.201(j)).

Total underground coal production in 2009 was approximately 63,210 tons for anthracite mines affected by final § 70.201(j). Multiplying the tonnage by the 2010 price per ton generates coal revenues of \$3.76 million for anthracite mines affected by final § 70.201(j).

Surface Coal Mines

Total surface coal production in 2009 was approximately 494.8 million tons for mines with 1-500 employees. Multiplying the tonnage by the 2010 price per ton generates surface coal revenue of \$11.9 billion for mines with 1-500 employees.

²⁷ U.S. DOE, EIA, "Annual Coal Report 2010," Table 28 shows price of coal per ton for all underground coal mines and Table 31 shows price of coal per ton for anthracite mines, DOE/EIA-0584(2010).

Total surface coal production in 2009 was approximately 19.7 million tons for mines with 1-19 employees. Multiplying the tonnage by the 2010 price per ton generates surface coal revenue of \$475.7 million for mines with 1-19 employees.

There were no comments on the effects of the proposed rule on surface anthracite coal mines. In addition, unlike underground anthracite coal mines, surface anthracite coal mines do not have notable differences in the conditions and type of equipment, when compared to other surface coal mines.

Screening Analysis for Underground Coal Mines

Table VI-1 below shows MSHA's estimate of the cost of the final rule compared to mine revenue, by mine size for underground coal mines.

**Table VI-1: Cost of Final Rule Compared to Mine Revenues,
By Mine Size, for Underground Coal Mines**

Mine Size	No. of Mines	Annualized Cost of Final Rule (including Transfer Payments)	Estimated Revenues (in Millions)	Cost per Mine	Cost of Final Rule as Percent of Revenues
1-500 Employees	412	\$24,690,038	\$14,673	\$59,927	0.17%
Mines with 1-19 Employees	81	\$1,493,077	\$305.8	\$18,433	0.49%
Anthracite Mines Affected by §70.201(j) with 1-19 Employees	8	\$40,618	\$3.76	\$5,077	1.08%

As shown in Table VI-1, when applying SBA's definition of a small mine, the annualized cost of the final rule for underground coal mines with 1-500 employees is approximately \$24.7 million (including transfer payments or penalties), or approximately \$59,950 per mine. This is equal to approximately 0.17 percent of annual revenue.

The Annualized cost of the final rule for underground coal mines with 1-19 employees is approximately \$1.5 million (including transfer payments or penalties), or approximately \$18,433 per mine. This is equal to approximately 0.49 percent of annual revenues.

The annualized cost of the final rule for anthracite underground coal mines affected by final § 70.201(j) is approximately \$40,625, or approximately \$5,100 per mine. This is equal to approximately 1.08 percent of annual revenues. The underground anthracite coal mines affected by final § 70.201(j) will not incur all the compliance costs noted in Chapter IV of this REA because they do not mine coal using a continuous mining machine or longwall equipment. For example, since these mines use hand loading methods to mine coal they will not incur additional costs for engineering controls that are found in mines that use the continuous mining or longwall method to mine coal. In addition, final § 70.201(j) does not require these mines to use a CPDM

to conduct sampling required by the final rule; therefore, CPDM sampling costs are not included for these mines. Compliance costs for these anthracite coal mines include increased costs for: recording production, shift length and information concerning on-shift exams; periodic examinations, and additional sampling.

MSHA estimates that some mines might experience higher costs than the average cost per mine in their size category while others might experience lower costs. Based on its analysis, MSHA has determined that the final rule will not have a significant economic impact on a substantial number of small underground coal mine operators under SBA's definition or MSHA's traditional definition of a small mine.

Screening Analysis for Surface Coal Mines

Table VI-2 below shows MSHA's estimate of the cost of the final rule compared to mine revenue, by mine size for surface coal mines.

Table VI-2: Cost of Final Rule Compared to Mine Revenues, by Mine Size, for Surface Coal Mines

Mine Size	No. of Mines	Annualized Cost of Final Rule (including Transfer Payments)	Estimated Revenues (in Millions)	Cost per Mine	Cost of Final Rule as Percent of Revenues
1-500 Employees	1119	\$3,693,797	\$11,939	\$3,301	0.03%
Mines with 1-19 Employees	620	\$1,004,222	\$475.7	\$1,620	0.21%

As shown in Table VI-2, when applying SBA's definition of a small mine, the annualized cost of the final rule for surface coal mines with 1-500 employees is approximately \$3.7 million, or approximately \$3,300 per mine. This is equal to approximately 0.03 percent of annual revenue.

The annualized cost of the final rule for surface coal mines with 1-19 employees is approximately \$1.0 million, or approximately \$1,625 per mine. This is equal to approximately 0.21 percent of annual revenues.

Since the estimate of costs is well below one percent of revenues, MSHA has determined that the final rule will not have a significant economic impact on a substantial number of small surface coal mine operators.

Conclusion

Based on all analyses, the annualized costs of the final rule are less than one percent of annual revenues for both small underground and small surface coal mines, as defined by SBA. Therefore, MSHA certifies that the final rule will not have a significant impact on a substantial number of small mining entities.

VII. OTHER REGULATORY CONSIDERATIONS

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)

The National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321 et. seq.), requires each Federal agency to consider the environmental effects of final actions and to prepare an Environmental Impact Statement on major actions significantly affecting the quality of the environment. The final respirable coal mine dust rule has been reviewed in accordance with the requirements of the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321 et seq.), the regulations of the Council of Environmental Quality (CEQ) (40 CFR part 1500) and the Department of Labor's NEPA compliance procedures (29 CFR part 11). In the Federal Register of October 19, 2010 (75 FR 64412), MSHA made a preliminary determination that the proposed respirable coal mine dust rule was of a type that does not have a significant impact on the human environment. MSHA's preliminary determination was based on its environmental assessment which considered the factors set forth in 29 CFR 11.11(c). MSHA has complied with the requirements of the NEPA, including the Department of Labor's compliance procedures and the regulations of the Council on Environmental Quality. The Agency has not received any new information or comments that would affect its previous determination. As a result of the Agency's review of the final respirable coal mine dust rule, MSHA has concluded that the rule will not have significant environmental impacts, and therefore an environmental impact statement is not required.

THE UNFUNDED MANDATES REFORM ACT

MSHA has reviewed the final rule under the Unfunded Mandates Reform Act of 1995 (2 U.S.C. 1501 et seq.). MSHA has determined that this final rule does not include any federal mandate that may result in increased expenditures by State, local, or tribal governments; nor will it increase private sector expenditures by more than \$100 million (adjusted for inflation) in any one year or significantly or uniquely affect small governments. Accordingly, the Unfunded Mandates Reform Act of 1995 (2 U.S.C. 1501 et seq.) requires no further Agency action or analysis.

THE TREASURY AND GENERAL GOVERNMENT APPROPRIATIONS ACT OF 1999: ASSESSMENT OF FEDERAL REGULATIONS AND POLICIES ON FAMILIES

Section 654 of the Treasury and General Government Appropriations Act of 1999 (5 U.S.C. 601) requires agencies to assess the impact of Agency action on family well-being. MSHA has determined that the final rule will have no effect on family stability or safety, marital commitment, parental rights and authority, or income or poverty of families and children. The final rule impacts the coal mine industry. Accordingly, MSHA certifies that the final rule will not impact family well-being.

EXECUTIVE ORDER 12630: GOVERNMENT ACTIONS AND INTERFERENCE WITH CONSTITUTIONALLY PROTECTED PROPERTY RIGHTS

This final rule does not implement a policy with takings implications. Accordingly, under E.O. 12630, no further Agency action or analysis is required.

EXECUTIVE ORDER 12988: CIVIL JUSTICE REFORM

The final rule was written to provide a clear legal standard for affected conduct and was reviewed to eliminate drafting errors and ambiguities, so as to minimize litigation and undue burden on the Federal court system. Accordingly, the final rule will meet the applicable standards provided in section 3 of E.O. 12988, Civil Justice Reform.

EXECUTIVE ORDER 13045: PROTECTION OF CHILDREN FROM ENVIRONMENTAL HEALTH RISKS AND SAFETY RISKS

The final rule will have no adverse impact on children. Accordingly, under E.O. 13045, no further Agency action or analysis is required.

EXECUTIVE ORDER 13132: FEDERALISM

The final rule does not have “federalism implications” because it will not “have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government.” Accordingly, under E.O. 13132, no further Agency action or analysis is required.

EXECUTIVE ORDER 13175: CONSULTATION AND COORDINATION WITH INDIAN TRIBAL GOVERNMENTS

The final rule does not have “tribal implications” because it will not “have substantial direct effects on one or more Indian tribes, on the relationship between the Federal government and Indian tribes, or on the distribution of power and responsibilities between the Federal government and Indian tribes.” Accordingly, under E.O. 13175, no further Agency action or analysis is required.

EXECUTIVE ORDER 13211: ACTIONS CONCERNING REGULATIONS THAT SIGNIFICANTLY AFFECT ENERGY SUPPLY, DISTRIBUTION, OR USE

Executive Order 13211 requires agencies to publish a statement of energy effects when a rule has a significant energy action that adversely affects energy supply, distribution or use. The final rule has been reviewed for its impact on the supply, distribution, and use of energy because it applies to the coal mining industry. Insofar as the final rule will result in annualized costs of \$27.1 million (includes costs to underground coal mine operators and penalties) for the underground coal industry relative to annual revenues of \$20 billion in 2010 dollars and annualized costs of \$4 million (includes costs to surface coal mine operators and penalties) for surface coal industry relative to annual revenues of \$17.9 billion in 2010 dollars, it is not a “significant energy action” because it is not “likely to have a significant adverse effect on the

supply, distribution, or use of energy ... (including a shortfall in supply, price increases, and increased use of foreign supplies).” Accordingly, Executive Order 13211 requires no further Agency action or analysis.

EXECUTIVE ORDER 13272: PROPER CONSIDERATION OF SMALL ENTITIES IN AGENCY RULEMAKING

MSHA has thoroughly reviewed the final rule to assess and take appropriate account of its potential impact on small businesses, small governmental jurisdictions, and small organizations. MSHA has determined and certified that the final rule does not have a significant economic impact on a substantial number of small entities.

VIII. PAPERWORK REDUCTION ACT OF 1995

INTRODUCTION

This section shows MSHA's estimate for the paperwork burden hours and related costs to underground and surface coal mine operators under the final rule. The burden hour and cost estimates presented in this chapter are based on the detailed analysis presented in Chapter IV. The estimates for underground coal mine operators, including part 90 miners employed at underground coal mines, are presented first followed by the estimates for surface coal mine operators, including part 90 miners employed at surface coal mines.

SUMMARY OF PAPERWORK BURDEN HOURS AND RELATED COSTS

Table VIII-1 shows that, in the first year the final rule is in effect, underground and surface coal mine operators would incur 181,955 burden hours with related costs of approximately \$9.7 million; in the second year 175,101 burden hours with related costs of approximately \$9.4 million and in the third year 171,908 burden hours with related costs of \$9.3 million.

Table VIII-1: Summary of Burden Hours and Costs

Detail of Burden	Year 1		Year 2		Year 3	
	Burden Hours	Hour Burden Cost	Burden Hours	Hour Burden Cost	Burden Hours	Hour Burden Cost
Mine Ventilation Plans	742	\$45,026	0	\$0	0	\$0
Abatement Sampling	1,383	\$63,761	919	\$47,263	1,450	\$83,254
Meeting or Exceeding the ECV	395	\$39,169	570	\$48,273	884	\$74,866
Record of Material Produced	27,756	\$2,350,656	27,756	\$2,350,656	27,756	\$2,350,656
Record of Shift Length	23,848	\$750,317	23,848	\$750,317	23,848	\$750,317
Gravimetric Sampler	6,572	\$235,105	1,772	\$52,864	-2,566	-\$107,300
CPDMs at UG Mines	77,621	\$2,578,712	77,621	\$2,578,712	77,621	\$2,578,712
75.362 Examinations	42,150	\$3,569,684	42,150	\$3,569,684	42,150	\$3,569,684
Periodic Examinations & Respiratory Protection	1,486	\$96,135	163	\$6,924	163	\$6,926
Part 90 Surface CPDMs	2	\$48	302	\$8,487	602	\$16,926
Totals	181,955	\$9,722,897	175,101	\$9,413,180	171,908	\$9,324,041

DESCRIPTION OF PAPERWORK PROVISIONS

A. Mine Ventilation Plans

Mine Ventilation Plan; submission and approval and Mine Ventilation Plan; contents

The final rule revises existing § 75.371(f) and (j). Final § 75.371(f) and (j) revises the information related to respirable dust control measures that underground coal mine operators will be required to provide in mine ventilation plans under existing § 75.370. Operators will need to revise their mine ventilation plans to include additional engineering controls that will be used to comply with the final rule. There is a one-time cost to make these revisions to comply with the final rule. After initial revisions have been made, further updates can be made when operators' normally revise their ventilation plans. Also, under final § 70.201(b)(2) the operator will conduct DA sampling with an approved CMDPSU unless the operator notifies the District Manager in writing that an approved CPDM will be used for all DA sampling. MSHA does not expect that operators will choose to conduct DA sampling with a CPDM; however, if they choose to do so, the notification can be submitted to MSHA along with the revisions noted above.

All underground coal mines will need to make the above revisions under existing § 75.370(a)(2). On average, MSHA estimates that 1 hour is sufficient for a supervisor, earning \$84.69 per hour, to make the plan revisions and any notifications of intent to use CPDMs for DA sampling. On average, MSHA estimates that a clerical employee, earning \$28.67 per hour, will take 15 minutes (0.25 hours) to prepare and send the revisions and any notifications to MSHA. First year burden hours and hour burden costs for underground coal mines are shown below:

Burden Hours

424 plans x 1 hr.	= 424 hrs.
424 plans x 0.25 hrs.	= <u>106 hrs.</u>
Total Burden Hours	= 530 hrs.

Hour Burden Costs

424 hrs. x \$84.69 wage rate	= \$35,909
106 hrs. x \$28.67 wage rate	= <u>\$ 3,039</u>
Total Hour Burden Costs	= \$38,948

Under existing § 75.370(a)(3)(i) and (f)(1), underground coal mine operators are required to notify the miners' representative at least 5 days prior to submission of a mine ventilation plan revision for MSHA approval and, if requested, provide a copy of the proposed and approved revisions to the miners' representative. MSHA assumes that a copy of the revisions will be requested. The number of copies provided to miners' representatives is estimated to be 424 plans, and equals the number of revisions noted above. MSHA estimates that a clerical employee will take 15 minutes (0.25 hours) to

notify and provide a copy of the revisions. First year burden hours and hour burden costs for underground coal mines are shown below:

$$\begin{array}{l} \text{Burden Hours} \\ 424 \text{ plans} \times 0.25 \text{ hrs.} \end{array} = 106 \text{ hrs.}$$

$$\begin{array}{l} \text{Hour Burden Costs} \\ 106 \text{ hrs.} \times \$28.67 \text{ wage rate} \end{array} = \$3,039$$

Underground coal mine operators must post a copy of the revisions of the mine ventilation plan under existing § 75.370(a)(3)(iii) and (f)(3). The number of postings is equal to the number of revisions. MSHA estimates that it takes a clerical employee 15 minutes (0.25 hours) to post a copy of the revisions to the mine ventilation plan. First year burden hours and hour burden costs for underground coal mines are shown below:

$$\begin{array}{l} \text{Burden Hours} \\ 424 \text{ plans} \times 0.25 \text{ hrs.} \end{array} = 106 \text{ hrs.}$$

$$\begin{array}{l} \text{Hour Burden Costs} \\ 106 \text{ hrs.} \times \$28.67 \text{ wage rate} \end{array} = \$3,039$$

B. Abatement Sampling

Record and Certify Corrective Actions

On implementation of corrective actions, a record of the corrective actions must be made and certified under final §§ 70.206(h)(3), 70.207(g)(3), 70.208(h)(3), 70.209(f)(3) at underground coal mines; final § 71.206(k)(3) at surface coal mines; and final § 90.207(f)(3) for part 90 miners. MSHA estimates that, on average, it takes 12 minutes (0.2 hours) to make a record of corrective actions and certify the record. MSHA assumes that a supervisory person, earning \$84.69 per hour in an underground coal mine and \$71.18 per hour in a surface coal mine, will make the record. In addition, MSHA assumes that a mine foreman or equivalent mine official that certifies the record also earns a supervisory hourly wage rate. First, second and third year burden hours and hour burden costs for underground and surface coal mines are shown below:

Underground Coal Mine Operators – Year One:

$$\begin{array}{l} \text{Burden Hours} \\ 675 \text{ records} \times 0.2 \text{ hrs.} \end{array} = 135 \text{ hrs.}$$

$$\begin{array}{l} \text{Hour Burden Costs} \\ 135 \text{ hrs.} \times \$84.69 \text{ wage rate} \end{array} = \$11,433$$

Underground Coal Mine Operators – Year Two:

Burden Hours

467 records x 0.2 hrs. = 93 hrs.

Hour Burden Costs

93 hrs. x \$84.69 wage rate = \$7,876

Underground Coal Mine Operators – Year Three:

Burden Hours

771 records x 0.2 hrs. = 154 hrs.

Hour Burden Costs

154 hrs. x \$84.69 wage rate = \$13,042

Surface Coal Mine Operators – Year One

Burden Hours

42 records x 0.2 hrs. = 8 hrs.

Hour Burden Costs

8 hrs. x \$71.18 wage rate = \$569

Surface Coal Mine Operators – Year Two

Burden Hours

25 records x 0.2 hrs. = 5 hrs.

Hour Burden Costs

5 hrs. x \$71.18 wage rate = \$356

Surface Coal Mine Operators – Year Three

Burden Hours

32 records x 0.2 hrs. = 6 hrs.

Hour Burden Costs

6 hrs. x \$71.18 wage rate = \$427

Complete and Sign Dust Data Card and Send with Sample to MSHA

Under final §§ 70.210(a), (c), and (f) at underground coal mines, 71.207(a), (c), and (f) at surface coal mines, and 90.208(a), (c), and (f) for part 90 miners, operators will complete and sign Dust Data Cards and submit abatement samples and the Dust Data Cards to MSHA. Each citation generates five abatement samples. The burden for final §§ 70.210(c) and 90.208(c) include the burdens for final §§ 70.205(b)(2) and 90.205(b)(2) since MSHA assumes that any notations required to be made on the Dust

Data Card can be made at the same time. For the same reason, the burden for final § 71.207(c) includes the burdens for final §§ 71.205(b)(2) and 71.206(e).

In the first year that the final rule is in effect, underground and surface coal operators will conduct abatement sampling with the gravimetric sampler. In the second year that the final rule is in effect, MSHA assumes that: underground coal operators will take abatement samples with the gravimetric sampler for half of the citations while the remaining half will be taken with the CPDM; surface coal mine operator will take abatement samples with the gravimetric sampler. In the third year that the final rule is in effect, and for every year thereafter, underground coal mines will have abatement sampling done with the CPDM and surface coal mines will have abatement sampling done with the gravimetric sampler.

Submitting Abatement Samples When Using a Gravimetric Sampler

When abatement sampling is conducted with the gravimetric sampler, the sample must be mailed with a control filter and completed dust data card, to MSHA. Costs for submitting a sample are as follows. MSHA estimates that the person completing the Dust Data Card is a certified technician earning \$33.23 per hour in an underground coal mine and \$28.13 in a surface coal mine. MSHA estimates that, on average, a certified dust technician will take 6 minutes (0.1 hours) to complete and send the Dust Data Card with the sample to MSHA. MSHA estimates that a certified person, earning \$84.69 per hour in an underground coal mine and \$71.18 per hour in a surface coal mine, takes 1.5 minutes (0.025 hours) to review and sign the Dust Data Card, and include that person's MSHA Individual Identification Number (MIIN).

Submitting Abatement Samples When Using the CPDM

When conducting abatement sampling with the CPDM, the sample is transmitted electronically and no mailing occurs. MSHA estimates that validating, certifying, and uploading the abatement sampling data from the CPDM to a computer and then transmitting the data electronically to MSHA takes a designated mine official, earning a supervisor's hourly wage of \$84.69, 6 minutes (0.1 hours). First, second and third year burden hours and hour burden costs for underground and surface coal mines are shown below:

Underground Coal Mine Operators – Year One

Burden Hours

3,375 data cards x 0.1 hrs.	= 338 hrs.
3,375 data cards x 0.025 hrs.	= 84 hrs.
Total Burden Hours	= 422 hrs.

Hour Burden Costs

338 hrs. x \$33.23 wage rate	= \$11,232
84 hrs. x \$84.69 wage rate	= \$7,114
Total Hour Burden Costs	= \$18,346

First Half of Second Year

In the first half of the second year, sampling will be conducted like it was conducted in the first year.

Underground Coal Mine Operators – First half of Year Two:

Burden Hours

1,175 data cards x 0.1 hrs. = 118 hrs.

1,175 data cards x 0.025 hrs. = 29 hrs.

Total Burden Hours = 147 hrs.

Hour Burden Costs

118 hrs. x \$33.23 wage rate = \$3,921

29 hrs. x \$84.69 wage rate = \$2,456

Total Hour Burden Costs = \$6,380

Remaining Half of Second Year

In the second half of the second year, and for every year thereafter, underground coal mine operators will use the CPDM to conduct abatement sampling.

Underground Coal Mine Operators – Second half of Year Two:

Burden Hours

1,160 data cards x 0.1 hrs. = 116 hrs.

Hour Burden Costs

116 hrs. x \$84.69 wage rate = \$9,824

Underground Coal Mine Operators – Year Three:

Burden Hours

3,855 data cards x 0.1 hrs. = 386 hrs.

Hour Burden Costs

386 hrs. x \$84.69 wage rate = \$32,690

Surface Coal Mine Operators – Year One

Burden Hours

210 data cards x 0.1 hrs. = 21 hrs.

210 data cards x 0.025 hrs. = 5 hrs.

Total Burden Hours = 26 hrs.

Hour Burden Costs

21 hrs. x \$28.13 wage rate = \$591

5 hrs. x \$71.18 wage rate = \$356

Total Hour Burden Cost = \$947

Surface Coal Mine Operators – Year Two

Burden Hours

125 data cards x 0.1 hrs.	= 13 hrs.
125 data cards x 0.025 hrs.	= <u>3 hrs.</u>
Total Burden Hours	= 16 hrs.

Hour Burden Costs

13 hrs. x \$28.13 wage rate	= \$366
3 hrs. x \$71.18 wage rate	= <u>\$214</u>
Total Hour Burden Cost	= \$580

Surface Coal Mine Operators – Year ThreeBurden Hours

160 data cards x 0.1 hrs.	= 16 hrs.
160 data cards x 0.025 hrs.	= <u>4 hrs.</u>
Total Burden Hours	= 20 hrs.

Hour Burden Costs

16 hrs. x \$28.13 wage rate	= \$450
4 hrs. x \$71.18 wage rate	= <u>\$285</u>
Total Hour Burden Cost	= \$735

Posting Sample Results or Providing Results to the Part 90 Miner

Operators are required to post sampling data from the MSHA report and the paper record (Dust Data Card) under final §§ 70.211(b) and (c), respectively, for underground coal mines, and under final § 71.208(b) and (c), respectively for surface coal mines. (The operator can post the report since the report contains the sampling data). Under § 90.209(b) and (c), underground and surface coal mine operators must provide a copy of the MSHA report and the paper record (Dust Data Card) to the affected part 90 miner. For purposes of this cost analysis, MSHA assumes that it takes the same amount of time to provide a copy of the sampling data to the part 90 miner as it does to post the data from the MSHA report on the mine bulletin board. MSHA also assumes that posting the data from the MSHA report under final § 70.211(b) and the Dust Data Card of the sample run under final § 70.211(c) can be done at the same time. Similarly, providing the part 90 miner with the MSHA report under final § 90.209(b) and the Dust Data Card of the sample run under final § 90.209(c) can be done at the same time. On average, MSHA estimates that a clerical employee, earning \$28.67 per hour in an underground coal mine and \$23.91 in a surface coal mine, takes 6 minutes (0.1 hours) to copy and post the sampling data. MSHA's current practice is to transmit the MSHA reports to the operator in a group, so the number of times to post or provide results to the part 90 miner equates to the number of citations issued. First, second and third year burden hours and hour burden costs for underground and surface coal mines are shown below:

Underground Coal Mine Operators – Year OneBurden Hours

675 posting of sampling data or provide data to part 90 miner

x 0.1 hrs. = 68 hrs.

Hour Burden Costs

68 hrs. x \$28.67 wage rate = \$1,950

Underground Coal Mine Operators – Year Two

Burden Hours

467 postings of sampling data or provide data to part 90 miner
x 0.1 hrs. = 47 hrs.

Hour Burden Costs

47 hrs. x \$28.67 wage rate = \$1,348

Underground Coal Mine Operators – Year Three

Burden Hours

771 postings of sampling data or provide data to part 90 miner
x 0.1 hrs. = 77 hrs.

Hour Burden Costs

77 hrs. x \$28.67 wage rate = \$2,208

Surface Coal Mine Operators – Year One

Burden Hours

42 postings of sampling data or provide data to part 90 miner
x 0.1 hrs. = 4 hrs.

Hour Burden Costs

4 hrs. x \$23.91 wage rate = \$96

Surface Coal Mine Operators – Year Two

Burden Hours

25 postings of sampling data or provide data to part 90 miner
x 0.1 hrs. = 3 hrs.

Hour Burden Costs

3 hrs. x \$23.91 wage rate = \$72

Surface Coal Mine Operators – Year Three

Burden Hours

32 postings of sampling data or provide data to part 90 miner
x 0.1 hrs. = 3 hrs.

Hour Burden Costs

3 hrs. x \$23.91 wage rate = \$72

Revisions to Mine Ventilation Plan or Develop or Revise a Dust Control Plan

To terminate a citation for violation of the respirable dust standard under the final rule, operators may make revisions to mine ventilation plans under §§ 70.206(i)(2), 70.207(h)(2), 70.208(i)(2), and 70.209(g)(2) at underground coal mines; develop or make revisions to respirable dust control plans under § 71.300 (a) at surface coal mines; and develop or make revisions to respirable dust control plans under § 90.300(a) for part 90 miners. There are occasions when a citation will not result in an operator having to revise the mine ventilation plan or develop or revise a dust control plan. For example, a change in the plan may not be needed if the citation can be abated by simply following the current plan. However, as a conservative estimate for this analysis MSHA assumes that all citations will lead to a revision to the mine ventilation plan or development or revision of a dust control plan. Thus, the number of plan developments or revisions equals the number of citations issued.

On average, MSHA estimates that it takes a supervisor, earning \$84.69 per hour in an underground coal mine and \$71.18 per hour in a surface coal mine, 15 minutes (0.25 hours) to develop or make a plan revision. Also, MSHA estimates that it takes a clerical employee, earning \$28.67 in an underground coal mine and \$23.91 in a surface coal mine, another 15 minutes (0.25 hours) to prepare and send the material to MSHA. First, second and third year burden hours and hour burden costs for underground and surface coal mines are shown below:

Underground Coal Mine Operators – Year One:

Burden Hours

675 plans x 0.25 hrs.	= 169 hrs.
675 plans x 0.25 hrs.	= <u>169 hrs.</u>
Total Burden Hours	= 338 hrs.

Hour Burden Costs

169 hrs. x \$28.67 wage rate	= \$ 4,845
169 hrs. x \$84.69 wage rate	= <u>\$14,313</u>
Total Hour Burden Costs	= \$19,158

Underground Coal Mine Operators – Year Two:

Burden Hours

467 plans x 0.25 hrs.	= 117 hrs.
467 plans x 0.25 hrs.	= <u>117 hrs.</u>
Total Burden Hours	= 234 hrs.

Hour Burden Costs

117 hrs. x \$28.67 wage rate	= \$ 3,354
117 hrs. x \$84.69 wage rate	= <u>\$9,909</u>
Total Hour Burden Costs	= \$13,263

Underground Coal Mine Operators – Year Three:

Burden Hours

771 plans x 0.25 hrs.	= 193 hrs.
771 plans x 0.25 hrs.	= <u>193 hrs.</u>
Total Burden Hours	= 386 hrs.
<u>Hour Burden Costs</u>	
193 hrs. x \$28.67 wage rate	= \$5,533
193 hrs. x \$84.69 wage rate	= <u>\$16,345</u>
Total Hour Burden Costs	= \$21,878

Surface Coal Mine Operators – Year One

<u>Burden Hours</u>	
42 plans x 0.25 hrs.	= 11 hrs.
42 plans x 0.25 hrs.	= <u>11 hrs.</u>
Total Burden Hours	= 22 hrs.
<u>Hour Burden Costs</u>	
11 hrs. x \$23.91 wage rate	= \$ 263
11 hrs. x \$71.18 wage rate	= <u>\$783</u>
Total Hour Burden Cost	= \$1,046

Surface Coal Mine Operators – Year Two

<u>Burden Hours</u>	
25 plans x 0.25 hrs.	= 6 hrs.
25 plans x 0.25 hrs.	= <u>6 hrs.</u>
Total Burden Hours	= 12 hrs.
<u>Hour Burden Costs</u>	
6 hrs. x \$23.91 wage rate	= \$143
6 hrs. x \$71.18 wage rate	= <u>\$427</u>
Total Hour Burden Cost	= \$570

Surface Coal Mine Operators – Year Three

<u>Burden Hours</u>	
32 plans x 0.25 hrs.	= 8 hrs.
32 plans x 0.25 hrs.	= <u>8 hrs.</u>
Total Burden Hours	= 16 hrs.
<u>Hour Burden Costs</u>	
8 hrs. x \$23.91 wage rate	= \$191
8 hrs. x \$71.18 wage rate	= <u>\$569</u>
Total Hour Burden Cost	= \$760

Notify Miners' Representative

Operators are required to notify the miners' representatives of developed or revised plans and if requested provide them with a copy of the proposed and approved revisions (under existing § 75.370(a)(3)(i) and (f)(1) for underground coal mine operators and final §§ 71.300(a)(1) and 71.301(d)(1) for surface coal mine operators) and provide the part 90 miner with a copy of a developed or revised plan (under final § 90.301(d)). MSHA estimates that a clerical employee, earning \$28.67 per hour in an underground coal mine and \$23.91 in a surface coal mine, takes 15 minutes (0.25 hours) to notify and provide a copy of the plan or revisions to the miners' representative or part 90 miner. MSHA assumes that all miners' representatives will request a copy of the plan or revisions. The number of notifications is equal to the number of citations. First, second and third year burden hours and hour burden costs for underground and surface coal mines are shown below:

Underground Coal Mine Operators – Year One:

Burden Hours

675 plans x 0.25 hrs. = 169 hrs.

Hour Burden Costs

169 hrs. x \$28.67 wage rate = \$4,845

Underground Coal Mine Operators – Year Two:

Burden Hours

467 plans x 0.25 hrs. = 117 hrs.

Hour Burden Costs

117 hrs. x \$28.67 wage rate = \$3,354

Underground Coal Mine Operators – Year Three:

Burden Hours

771 plans x 0.25 hrs. = 193 hrs.

Hour Burden Costs

193 hrs. x \$28.67 wage rate = \$5,533

Surface Coal Mine Operators – Year One

Burden Hours

42 plans x 0.25 hrs. = 11 hrs.

Hour Burden Costs

11 hrs. x \$23.91 wage rate = \$263

Surface Coal Mine Operators – Year Two

<u>Burden Hours</u>	
25 plans x 0.25 hrs.	= 6 hrs.
<u>Hour Burden Costs</u>	
6 hrs. x \$23.91 wage rate	= \$143

Surface Coal Mine Operators – Year Three

<u>Burden Hours</u>	
32 plans x 0.25 hrs.	= 8 hrs.
<u>Hour Burden Costs</u>	
8 hrs. x \$23.91 wage rate	= \$191

Post Copy of Plan or Plan Revision

Operators must post a copy of proposed an approved plan or revisions under existing § 75.370(a)(3)(iii) and (f)(3) for underground coal mines; and final §§ 71.300(a)(3), and 71.301(d)(3) for surface coal mines. The number of postings equates to the number of citations issued. MSHA estimates that a clerical employee, earning \$28.67 in an underground coal mine and \$23.91 in a surface coal mine, takes 15 minutes (0.25 hours) to copy and post. First, second and third year burden hours and hour burden costs for underground and surface coal mines are shown below:

Underground Coal Mine Operators – Year One:

<u>Burden Hours</u>	
675 plans x 0.25 hrs.	= 169 hrs.
<u>Hour Burden Costs</u>	
169 hrs. x \$28.67 wage rate	= \$4,845

Underground Coal Mine Operators – Year Two:

<u>Burden Hours</u>	
467 plans x 0.25 hrs.	= 117 hrs.
<u>Hour Burden Costs</u>	
117 hrs. x \$28.67 wage rate	= \$3,354

Underground Coal Mine Operators – Year Three:

<u>Burden Hours</u>	
771 plans x 0.25 hrs.	= 193 hrs.
<u>Hour Burden Costs</u>	
193 hrs. x \$28.67 wage rate	= \$5,533

Surface Coal Mine Operators – Year One

<u>Burden Hours</u>	
42 plans x 0.25 hrs.	= 11 hrs.

Hour Burden Costs

11 hrs. x \$23.91 wage rate = \$263

Surface Coal Mine Operators – Year Two

Burden Hours

25 plans x 0.25 hrs. = 6 hrs.

Hour Burden Costs

6 hrs. x \$23.91 wage rate = \$143

Surface Coal Mine Operators – Year Three

Burden Hours

32 plans x 0.25 hrs. = 8 hrs.

Hour Burden Costs

8 hrs. x \$23.91 wage rate = \$191

C. Meeting or Exceeding the ECV

Record and Certify Corrective Actions

A record of corrective actions must be made and certified under final §§ 70.206(e)(3), 70.207(d)(3), 70.208(e)(3), 70.209(c)(3) at underground coal mines, and 90.207(c)(3) for part 90 miners, when 1 out of 5 valid, representative samples in a sampling period, or 1 or 2 out of 15 valid, representative samples in a sampling period, meets or exceeds the applicable ECV. MSHA estimates that, on average, it takes 12 minutes (0.2 hours) to make a record of corrective actions and certify the record. MSHA assumes that a supervisory person, earning \$84.69 per hour in an underground coal mine, will make the record. In addition, MSHA assumes that a mine foreman or equivalent mine official that certifies the record also earns a supervisory hourly wage rate. First, second and third year burden hours and hour burden costs for underground coal mines are shown below:

Underground Coal Mine Operators – Year One:

Burden Hours

1,972 records x 0.2 hrs. = 395 hrs.

Hour Burden Costs

395 hrs. x \$84.69 wage rate = \$33,453

Underground Coal Mine Operators – Year Two:

Burden Hours

2,849 records x 0.2 hrs. = 570 hrs.

Hour Burden Costs

570 hrs. x \$84.69 wage rate = \$48,273

Underground Coal Mine Operators – Year Three:

Burden Hours

4,418 records x 0.2 hrs. = 884 hrs.

Hour Burden Costs

884 hrs. x \$84.69 wage rate = \$74,866

D. Record of Production

Final § 70.201(g) requires the operator to record the amount of run-of-mine material produced by each MMU during each shift. Production data are used to determine the average production for the most recent 30 production shifts or for the most recent production shifts if fewer than 30 shifts of production data are available. The operator must retain production records for at least six months and make them available for inspection by authorized representatives of the Secretary and the miners' representative.

Some mines record the material produced per shift; however, most do not. Since nearly all mines with 1-19 employees operate 1 shift per day, MSHA estimates that the 81 MMUs in underground coal mines with 1-19 employees operate 1 shift per day (or 81 shifts per day). MSHA estimates that material produced is not recorded for 90 percent of these shifts, or 73 shifts per day (81 shifts x 90 percent). MSHA estimates that, on average, the 708 MMUs in underground coal mines with 20-500 employees operate 2 shifts per day (or 1,416 shifts per day). MSHA estimates that material produced is not recorded for 75 percent of these shifts operating each day or 1,062 shifts (1,416 shifts x 75 percent). All mines with 501+ employees are assumed to record the amount of material produced. MSHA estimates that the annual number of workdays is: 200 days in mines with 1-19 employees; and 300 days in mines with 20-500 employees. MSHA assumes that a supervisor, earning \$84.69 an hour, takes 5 minutes (0.0833 hours) to record the material produced on each shift. The annual burden hours and hour burden costs for underground coal mines are shown below:

Underground Coal Mine Operators

Burden Hours

333,200 shifts x 0.0833 hrs. = 27,756 hrs.

Hour Burden Costs

27,756 hrs. x \$84.69 wage rate = \$2,350,656

E. Record of Shift Length

Record of the Shift Length

Final §§ 70.201(e), 71.201(d) and 90.201(f) require the operator to make a record showing the length of each shift for each MMU, DWP and part 90 miner, to retain the records for at least six months, and to make the records available for inspection by authorized representatives of the Secretary, and, except in the case of part 90 miners, by the miners' representative.

For underground coal mine operators, final §§ 70.211(c) and 90.209(c) require that operators print, sign and post for each MMU or provide to each part 90 miner the shift length and other information from the Dust Data Card regarding CPDM samples. MSHA assumes that records of the shift length required by final §§ 70.201(e) and 90.201(f) are made at the same time that the Dust Data Card is printed under final §§ 70.211(c) and 90.209(c). The burden to record shift length required by final §§ 70.201(e) and 90.201(f) is in the burden for final §§ 70.211(c) and 90.209(c), respectively.

The requirement under final § 71.201(d) to record shift length for DWPs involves new burden costs for underground coal mine operators who have surface operations. Surface coal mine operators, too, will incur new burden costs for recording shift length for their DWPs.

For underground coal mines, MSHA estimates that it takes a miner, earning \$36.92 an hour, 1 minute (0.0167 hours) to record shift length for a DWP. MSHA estimates that the number of DWPs is: 13 DWPs in mines with 1-19 employees; 47 DWPs in mines with 20-500 employees; and 29 DWPs in mines with 501+ employees. MSHA estimates that the average number of shifts per day is 1 in mines with 1-19 employees, and 2 in mines with 20 or more employees. Also, MSHA estimates that the average number of workdays per year is: 200 in mines with 1-19 employees, 300 in mines with 20-500 employees, 350 in mines with 501+ employees.

For surface coal mines, MSHA estimates that it takes a miner, earning \$31.26 an hour, 1 minute (0.0167 hours) to record shift length for a DWP. MSHA estimates that the number of DWPs is: 1,107 DWPs in mines with 1-19 employees; 1,759 DWPs in mines with 20-500 employees; and 64 DWPs in mines with 501+ employees. MSHA estimates that the average number of shifts per day is: 1 in mines with 1-19 employees and 2 in mines with 20 or more employees. In addition, MSHA estimates that the average number of workdays per year is: 250 in mines with 1-19 employees; 300 in mines with 20-500 employees, and 350 in mines with 501+ employees.

The annual burden hours and hour burden costs for underground and surface coal mines are shown below:

Underground Coal Mine Operators

Burden Hours

51,100 DWP records x 0.0167 hrs. = 853 hrs.

Hour Burden Costs

853 hrs. x \$36.92 wage rate = \$31,493

Surface Coal Mine Operators

Burden Hours

1,376,950 DWP records x 0.0167 hrs. = 22,995 hrs.

Hour Burden Costs

22,995 hrs. x \$31.26 wage rate = \$718,824

F. Gravimetric Sampling

Listing the DWPs

Final § 71.206(d) requires operators to provide the MSHA District Manager with a list identifying the specific work positions where DWP samples will be collected. Also, under final § 71.201(a) the operator will conduct DWP sampling with an approved CMDPSU unless the operator notifies the District Manager in writing that an approved CPDM will be used for all DWP sampling. MSHA does not expect that operators will choose to conduct DWP sampling with a CPDM; however, if they choose to do so, the notification can be submitted to MSHA along with the list of DWPs. MSHA estimates that 12 minutes (0.2 hours) is sufficient for a supervisor to prepare the list and a notification. A supervisor's hourly wage rate is \$84.69 at underground coal mines and \$71.18 at surface coal mines. MSHA estimates that a clerical employee takes an additional 12 minutes (0.2 hours) to prepare and send the material to MSHA. A clerical employee's hourly wage rate is \$28.67 at underground coal mines and \$23.91 at surface coal mines.

MSHA estimates that the number of underground coal mines with surface areas that have DWPs is: 3 mines with 1-19 employees; 21 mines with 20-500 employees; and 8 mines with 501+ employees. MSHA estimates that the number of surface coal mines with DWPs is: 620 mines with 1-19 employees; 499 mines with 20-500 employees; and 4 mines with 501+ employees. The first year burden hours and hour burden costs for underground and surface coal mines are shown below:

Underground Coal Mine Operators

Burden Hours

32 mines x 0.2 hrs.	= 6 hrs.
32 mines x 0.2 hrs.	= <u>6 hrs.</u>
Total Burden Hours	= 12 hrs.

Hour Burden Costs

6 hrs. x \$28.67 wage rate	= \$172
6 hrs. x \$84.69 wage rate	= <u>\$508</u>
Total Hour Burden Costs	= \$680

Surface Coal Mine Operators

Burden Hours

1,123 mines x 0.2 hrs.	= 225 hrs.
1,123 mines x 0.2 hrs.	= <u>225 hrs.</u>
Total Burden Hours	= 450 hrs.

Hour Burden Costs

225 hrs. x \$23.91 wage rate	= \$ 5,380
225 hrs. x \$71.18 wage rate	= <u>\$16,016</u>
Total Hour Burden Cost	= \$21,396

Also, MSHA assumes that 10 percent of mines each year (including the first year) will update their lists. The annual burden hours and hour burden costs for underground and surface coal mines are shown below:

Underground Coal Mine Operators

Burden Hours

4 mines x 0.2 hrs.	= 1 hr.
4 mines x 0.2 hrs.	= <u>1 hr.</u>
Total Burden Hours	= 2 hrs.

Hour Burden Costs

1 hr. x \$28.67 wage rate	= \$29
1 hr. x \$84.69 wage rate	= <u>\$85</u>
Total Hour Burden Costs	= \$114

Surface Coal Mine Operators

Burden Hours

112 mines x 0.2 hrs.	= 22 hrs.
112 mines x 0.2 hrs.	= <u>22 hrs.</u>
Total Burden Hours	= 44 hrs.

Hour Burden Costs

22 hrs. x \$23.91 wage rate	= \$ 526
22 hrs. x \$71.18 wage rate	= <u>\$1,566</u>
Total Hour Burden Cost	= \$2,092

Transmitting the Samples to MSHA

Final §§ 70.210, 71.207 and 90.208 require each sample to be transmitted to MSHA with a completed Dust Data Card. The Dust Data Card is provided by the manufacturer with each filter cassette. Under §§ 70.210(c), 71.207(c) and 90.208(c), the person collecting the sample writes on each Dust Data Card information on the conditions when the sample was collected. Normally these tasks are performed by a certified dust technician earning \$33.23 per hour in an underground coal mine and \$28.13 per hour in a surface coal mine. On average, MSHA estimates that a certified dust technician takes 6 minutes (0.1 hours) to prepare and send one sample with the Dust Data Card, to MSHA.

After the Dust Data Card has been filled out, a certified person signs the card and includes that person's MSHA Individual Identification Number (MIIN) on the card. On average, MSHA estimates that a certified person (normally the mine safety inspector or an equivalent person, such as a supervisor) takes 1.5 minutes (0.025 hours) to complete and sign the Dust Data Card. MSHA also estimates that a supervisor's hourly wage rate is \$84.69 in an underground coal mine and \$71.18 in a surface coal mine. The first, second and third year burden hours and hour burden costs for underground coal mines

and the annual burden hours and hour burden costs for surface coal mines are shown below:

Underground Coal Mine Operators – Year One

Burden Hours

17,072 data cards x 0.1 hrs.	= 1,707 hrs.
17,072 data cards x 0.025 hrs.	= <u>427 hrs.</u>
Total Burden Hours	= 2,134 hrs.

Hour Burden Costs

1,707 hrs. x \$33.23 wage rate	= \$56,724
427 hrs. x \$84.69 wage rate	= <u>\$36,163</u>
Total Hour Burden Costs	= \$92,887

Underground Coal Mine Operators – Year Two:

Burden Hours Saved

(-2,210) data cards x 0.1 hrs.	= (-221) hrs.
(-2,210) data cards x 0.025 hrs.	= <u>(-55) hrs.</u>
Total Burden Hours Saved	= (-276) hrs.

Hour Burden Cost Savings

(-221) hrs. x \$33.23 wage rate	= \$ (-7,344)
(-55) hrs. x \$84.69 wage rate	= <u>\$ (-4,658)</u>
Total Hour Burden Cost Savings	= \$ (-12,002)

Underground Coal Mine Operators – Year Three:

Burden Hours Saved

(-21,492) data cards x 0.1 hrs.	= (-2,149) hrs.
(-21,492) data cards x 0.025 hrs.	= <u>(-537) hrs.</u>
Total Burden Hours Saved	= (-2,686) hrs.

Hour Burden Cost Savings

(-2,149) hrs. x \$33.23 wage rate	= \$ (-71,411)
(-537) hrs. x \$84.69 wage rate	= <u>\$ (-45,479)</u>
Total Hour Burden Cost Savings	= \$(-116,890)

Surface Coal Mine Operators – Annual

Burden Hours

9,878 data cards x 0.1 hrs.	= 988 hrs.
9,878 data cards x 0.025 hrs.	= <u>247 hrs.</u>
Total Burden Hours	= 1,235 hrs.

Hour Burden Costs

988 hrs. x \$28.13 wage rate	= \$27,792
247 hrs. x \$71.18 wage rate	= \$17,581
Total Hour Burden Cost	= \$45,373

Posting Sampling Data from the MSHA Reports and Providing MSHA Report to the Part 90 Miner

After processing the gravimetric samples, MSHA sends to the operator a report that contains the sampling data. Upon receiving the report, final §§ 70.211(b) and 71.208(b) require operators to post the sampling data on the mine bulletin board. (The operator can post the report since the report contains the sampling data). Final § 90.209(b) requires operators to provide part 90 miners with a copy of the MSHA report. For purposes of this cost analysis, MSHA assumes that it takes the same amount of time to provide a copy of the report to the part 90 miner as it does to post the data on the mine bulletin board. On average, MSHA estimates that a clerical employee takes 6 minutes (0.1 hours) to copy and post the data. The hourly wage rate for a clerical employee is \$28.67 in an underground coal mine and \$23.91 in a surface coal mine. The first, second and third year burden hours and hour burden costs for underground coal mines and the annual burden hours and hour burden costs for surface coal mines are shown below:

Underground Coal Mine Operators – Year One

Burden Hours

17,072 postings of sampling data or provide data to part 90 miner
x 0.1 hrs. = 1,707 hrs.

Hour Burden Costs

1,707 hrs. x \$28.67 wage rate = \$48,940

Underground Coal Mine Operators – Year Two:

Burden Hours Saved

(-2,210) postings of sampling data or provide data to part 90 miner
x 0.1 hrs. = (-221) hrs.

Hour Burden Cost Savings

(-221) hrs. x \$28.67 wage rate = \$(-6,336)

Underground Coal Mine Operators – Year Three:

Burden Hours Saved

(-21,492) postings of sampling data or provide data to part 90 miner
x 0.1 hrs. = (-2,149) hrs.

Hour Burden Cost Savings

(-2,149) hrs. x \$28.67 wage rate = \$(-61,612)

Surface Coal Mine Operators – Annual

Burden Hours

9,878 postings of sampling data or provide data to part 90 miner
x 0.1 hrs. = 988 hrs.

Hour Burden Costs

988 hrs. x \$23.91 wage rate = \$23,623

G. CPDMs Used at Underground Coal Mines

Validate, Certify, and Transmit CPDM Sampling Data to MSHA

Final §§ 70.210(f) and 90.208(f) apply when operators use CPDMs to sample. These standards require that within 24 hours after the end of each sampling shift, the person certified in sampling must validate, certify, and transmit to MSHA data file information collected and stored in the CPDM.

MSHA estimates that validating, certifying, and uploading the CPDM data to a computer and then transmitting it electronically to MSHA takes a person certified in sampling, earning \$33.23 an hour, 6 minutes (0.1 hours). The annual number of CPDM samples estimated in the REA for the before shift CPDM maintenance can be used for this requirement because every sample must be validated, certified and transmitted to MSHA within 24 hours after the end of each sampling shift by a certified person. The annual burden hours and hour burden costs for underground coal mines are shown below:

Underground Coal Mine Operators

Burden Hours

290,520 samples x 0.1 hrs. = 29,052 hrs.

Hour Burden Costs

29,052 hrs. x \$33.23 wage rate = \$965,398

Post Sampling Data from MSHA Report; Print, Sign and Post CPDM Sampling Dust Data Card; and Provide MSHA Report and Paper Record (Dust Data Card) to Part 90 Miners

Final § 70.211(b) requires the operator to post sampling data from MSHA report on the mine bulletin board and final § 90.209(b) requires the operator to provide copies of the MSHA report to part 90 miners. Under final § 70.211(b), the operator can post the report since it contains the sampling data.

Final §§ 70.211(c) and 90.209(c) apply to operators who use a CPDM. Final § 70.211(c) requires the person certified in sampling to print, sign and post a paper record (Dust Data Card) of the sample run on the mine bulletin board within 12 hours after the end of each sampling shift. Final § 90.209(c) requires the person certified in sampling to print, sign and provide the paper record (Dust Data Card) of the sample run to the part 90 miner within one hour after the start of the part 90 miner's next work shift.

The sampling data must include: 1) the mine identification number; 2) the location within the mine from which the sample was taken; 3) the concentration of respirable dust, expressed as an equivalent 8-hour concentration reported and stored for each sample; 4) sampling status conditions encountered for each sample; 5) the shift length; and 6) for the part 90 miner, the miner's MSHA Individual Identification number. This information is included in the available data that can be printed from the CPDM. MSHA expects a copy of the printout will be posted, or provided to the part 90 miner, to satisfy the requirements of those provisions.

Final § 70.201(e) requires the operator to make a record showing the length of each production shift for each MMU, retain the records for at least six months, make them available for inspection by authorized representatives of the Secretary and the miners' representative, and submit them to the District Manager when requested in writing. Final § 90.201(f) requires the operator to make a record showing the length of each shift for each part 90 miner, retain the records for at least six months, make them available for inspection by authorized representatives of the Secretary, and submit them to the District Manager when requested in writing. MSHA assumes that operators will record the shift length into a book to comply with final §§ 70.201(e) and 90.201(f) when they print out the Dust Data Card. The burden to record shift length required by final §§ 70.201(e) and 90.201(f) is accounted for in the burden for final §§ 70.211(c) and 90.209(c), respectively.

As noted above, final § 70.211(b) requires the operator to post an MSHA report on the mine bulletin board and final § 90.209(b) requires the operator to provide a copy of the MSHA report to the part 90 miner. Posting the MSHA report under final § 70.211(b) and the paper record (Dust Data Card) of the sample run under final § 70.211(c) can be done at the same time. Similarly, providing the part 90 miner with the MSHA report under final § 90.209(b) and the paper record (Dust Data Card) of the sample run under final § 90.209(c) can be done at the same time. MSHA assumes that it takes the same amount of time to provide a copy of the MSHA report to the part 90 miner as it does to post the sample date on the mine bulletin board.

The estimates of the number of CPDM samples per year are used to derive the burden hours and hour burden costs to print, sign and post the paper record (Dust Data Card) of the sampling data and provide the sampling data to the part 90 miner. MSHA estimates that a person certified in sampling, earning \$33.23 an hour, takes 10 minutes (0.1667 hours) to print, sign and post the CPDM Dust Data Card or provide the sampling data to the part 90 miner. The annual burden hours and hour burden costs for underground coal mines are shown below:

Underground Coal Mine Operators

Burden Hours

290,520 postings of sampling data or provide data to part 90 miner	
x 0.1667 hrs.	= 48,430 hrs.

Hour Burden Costs

48,430 hrs. x \$33.23 wage rate	= \$1,609,329
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Records for CPDM Training

Final §§ 70.201(i) and 90.201(i) require coal mine operators to keep a record of miners who receive CPDM training. The estimate of the number of miners at underground coal mines who will receive CPDM training presented above is 16,626. In addition, MSHA estimates that 66 part 90 miners will need annual training for a total of 16,692 miners that will receive annual training.

MSHA estimates that it takes a clerical employee 0.0083 hours (30 seconds) to make a record of each miner receiving CPDM training. The annual burden hours and hour burden costs for underground coal mine operators are shown below:

Underground Coal Mine Operators

Burden Hours

16,692 records x 0.0083 hrs. = 139 hrs.

Hour Burden Costs

139 hrs. x \$28.67 wage rate = \$3,985

H. On-Shift Examinations

Final § 75.362(a)(2) requires that the person conducting the examination to assure compliance with the respirable dust control parameters specified in the mine ventilation plan record the results of the examination and corrective actions taken at the end of each shift for each MMU. This requirement impacts only underground coal mines.

MSHA estimates that a supervisor, earning \$84.69 per hour, takes 3 minutes (0.05 hours) to make a record of the examination for the average mine in all mine sizes. On average, MSHA estimates that: 81 MMUs in mines with 1-19 employees have 1 shift per day (or 81 shifts per day); 708 MMUs in mines with 20-500 employees have 2 shifts per day (or 1,416 shifts per day); and 92 MMUs in mines with 501+ employees have 2 shifts per day (or 184 shifts per day). Records of the examinations will need to be made of these shifts each working day. On average, MSHA estimates that the number of workdays per year is: 200 days for mines with 1-19 employees; 300 days for mines with 20-500 employees; and 350 days for mines with 501+ employees. The annual burden hours and hour burden costs for underground coal mines are shown below:

Underground Coal Mine Operators

Burden Hours

505,400 records x 0.05 hrs. = 25,270 hrs.

Hour Burden Costs

25,270 hrs. x \$84.69 wage rate = \$2,140,116

Final § 75.362(g)(2)(i) requires that the final record required under § 75.362(a)(2) be certified by initials, date and time on a board maintained at the section load-out or similar location showing that the examination was made prior to resuming production.

This final standard does not add any new burden because the record is required under existing § 75.362(g)(2).

Final § 75.362(g)(2)(ii) requires that the record required under final § 75.362(a)(2) record be verified, by initials and date, by the certified person directing the on-shift examination. Final § 75.362(g)(3) requires that the mine foreman or equivalent official countersign each examination record under final § 75.362 (a)(2) after it is verified by the certified person in final paragraph (g)(2)(ii). MSHA estimates that it takes 1 minute (0.0167 hours) to verify the record by a certified person earning \$84.69 per hour; and another 1 minute (0.0167 hours) to review and countersign the record by a mine foreman or equivalent mine official earning \$84.69 per hour.

MSHA estimates that 505,400 records need to be verified and countersigned per year: 16,200 records in mines with 1-19 employees (81 shifts per day x 200 days per year); 424,800 records in mines with 20-500 employees (1,416 shifts per day x 300 days per year); and 64,400 records in mines with 501+ employees (184 shifts per day x 350 days per year). The annual burden hours and hour burden costs for underground coal mines are shown below:

Underground Coal Mine Operators

Burden Hours

505,400 records x 0.0167 hrs. = 8,440 hrs.

505,400 records x 0.0167 hrs. = 8,440 hrs.

Total Burden Hours =16,880 hrs.

Hour Burden Costs

8,440 hrs. x \$84.69 wage rate = \$ 714,784

8,440 hrs. x \$84.69 wage rate = \$ 714,784

Total Hour Burden Cost = \$1,429,568

I. Periodic Examinations

Develop Roster and Plan, and Post Plan

Final § 72.100 (a) requires each coal mine operator provide periodic examinations, including chest x-ray, spirometry, symptom assessment, and occupational history. Final § 72.100 also extends the periodic monitoring examinations requirement to miners at surface coal mines.

Final § 72.100 (d) requires each coal mine operator to develop and submit to the National Institute for Occupational Safety and Health (NIOSH) a plan as specified in 42 CFR Part 37 for providing miners with the examinations specified in final § 72.100(a) and a roster specifying the name and current address of each miner covered by the plan. Final § 72.100(e) requires operators to post the approved plan on the mine bulletin board.

Under existing 42 CFR 37.4, each operator of an underground coal mine is required to submit to NIOSH a plan for providing miners with the required chest x-rays and to post it on the mine bulletin board. It has also been a practice that operators submit to NIOSH an employee roster with the plan. MSHA assumes that, in the first year of the final rule, underground coal mine operators will revise the existing roster and plans for

periodic medical surveillance examinations, including chest x-rays to add spirometry examinations. In an underground coal mine, MSHA estimates that it takes a supervisor, earning \$84.69 an hour, 10 minutes (0.167 hours) to revise the roster and plan and a clerical employee, earning \$28.67 an hour, 5 minutes (0.0833 hours) to copy and submit the revised roster and plan and post the plan. The first year burden hours and hour burden costs for underground coal mines are shown below:

Underground Coal Mine Operators

Burden Hours

424 plans x 0.0833 hrs.	= 35 hrs.
424 plans x 0.167 hrs.	= <u>71 hrs.</u>
Total Burden Hours	= 106 hrs.

Hour Burden Costs

35 hrs. x \$28.67 wage rate	= \$1,003
71 hrs. x \$84.69 wage rate	= <u>\$6,013</u>
Total Hour Burden Costs	= \$7,016

Each surface coal mine operator will develop and submit to NIOSH a roster and plan for providing the examinations required under final § 72.100(a). In a surface coal mine, MSHA estimates that it takes a supervisor, earning \$71.18 per hour, 1 hour to develop the roster and plan and a clerical employee, earning \$23.91 an hour, 5 minutes (0.0833 hours) to copy and submit the roster and plan and post. The first year burden hours and hour burden costs for surface coal mines are shown below:

Surface Coal Mine Operators

Burden Hours

1,123 plans x 0.0833 hrs.	= 94 hrs.
1,123 plans x 1 hr.	= <u>1,123 hrs.</u>
Total Burden Hours	= 1,217 hrs.

Hour Burden Costs

94 hrs. x \$23.91 wage rate	= \$ 2,248
1,123 hrs. x \$71.18 wage rate	= <u>\$79,935</u>
Total Hour Burden Costs	= \$82,183

Revise and Post Plan

MSHA assumes that the plan required under § 72.100(d) must be provided to NIOSH at least once every 5 years and that each year one fifth of the mines will have to revise a plan to specify the 6 month period that the examinations will be available and the NIOSH-approved facility that will provide the examinations. Final § 72.100(e) requires the operator to post the approved plan. MSHA estimates that it takes a supervisor, earning \$84.69 an hour in an underground coal mine or \$71.18 an hour in a surface coal mine, 10 minutes (0.167 hours) to revise the plan and a clerical employee, earning \$28.67 an hour in an underground coal mine or \$23.91 an hour in a surface coal mine, 5 minutes

(0.0833 hours) to copy and submit the revised plan and post the plan. The annual burden hours and hour burden costs for underground and surface coal mines are shown below:

Underground Coal Mine Operators

Burden Hours

84 plans x 0.0833 hrs. = 7 hrs.

84 plans x 0.167 hrs. = 14 hrs.

Total Burden Hours = 21 hrs.

Hour Burden Costs

7 hrs. x \$28.67 wage rate = \$ 201

14 hrs. x \$84.69 wage rate = \$1,186

Total Hour Burden Costs = \$1,387

Surface Coal Mine Operators

Burden Hours

224 plans x 0.0833 hrs. = 19 hrs.

224 plans x 0.167 hr. = 37 hrs.

Total Burden Hours = 56 hrs.

Hour Burden Costs

19 hrs. x \$23.91 wage rate = \$ 454

37 hrs. x \$71.18 wage rate = \$2,634

Total Hour Burden Costs = \$3,088

Records for Respiratory Training

Final § 72.700(c) requires coal mine operators to keep a record of respirator training. MSHA estimates that it takes a clerical employee, earning \$28.67 an hour in an underground coal mine or \$23.91 an hour in a surface coal mine, 30 seconds (0.00833 hours) per trainee to make a record of respirator training. The annual burden hours and hour burden costs for underground coal mines are shown below:

Underground Coal Mine Operators

Burden Hours

10,254 records x 0.00833 hrs. = 85 hrs.

Hour Burden Costs

85 hrs. x \$28.67 wage rate = \$2,437

The first, second and third year burden hours and hour burden costs for surface coal mines are shown below:

Surface Coal Mine Operators – Year One

Burden Hours

93 records x 0.00833 hrs. = 1 hr.

Hour Burden Costs

$$1 \text{ hr.} \times \$23.91 \text{ wage rate} = \$24$$

Surface Coal Mine Operators – Year Two

Burden Hours

$$57 \text{ records} \times 0.00833 \text{ hrs.} = 0.5 \text{ hrs.}$$

Hour Burden Costs

$$0.5 \text{ hrs.} \times \$23.91 \text{ wage rate} = \$12$$

Surface Coal Mine Operators – Year Three

Burden Hours

$$73 \text{ records} \times 0.00833 \text{ hrs.} = 0.6 \text{ hrs.}$$

Hour Burden Costs

$$0.6 \text{ hrs.} \times \$23.91 \text{ wage rate} = \$14$$

J. CPDMs for Part 90 Miners at Surface Coal Mines

Records for CPDM Training

Final § 90.201(i) requires coal mine operators to keep a record of part 90 miners who receive CPDM training and final § 71.201(h) requires coal mine operators to keep a record of surface coal miners who receive CPDM training. There is no separate burden estimate for final § 71.201(h) because the only surface coal miners that are expected to be sampled with the CPDM and need CPDM training are part 90 miners. MSHA is accounting for burden for final § 71.201(h) in the burden for final § 90.201(i). MSHA estimates that it takes a clerical employee, earning \$23.91 per hour, 0.0083 hours (30 seconds) to make a record of each part 90 miner who received CPDM training. The annual burden hours and hour burden costs for surface coal mines are shown below:

Surface Coal Mine Operators

Burden Hours

$$200 \text{ records} \times 0.00833 \text{ hrs.} = 2 \text{ hrs.}$$

Hour Burden Costs

$$2 \text{ hrs.} \times \$23.91 \text{ wage rate} = \$48$$

Validate, Certify, and Transmit Part 90 Miner CPDM Sampling Data to MSHA

Final §§ 71.207(f) and 90.208(f) require that within 24 hours after the end of each sampling shift a person certified in sampling must validate, certify and transmit electronically to MSHA the sample data file information collected and stored in the CPDM, including sampling status conditions encountered when sampling the part 90 miner. Since surface coal miner operators are required to use the CPDM only for part 90 miner sampling the burden for final § 71.207(f) is accounted for in the burden for final § 90.208(f) below.

MSHA estimates that validating, certifying, and uploading the CPDM data from a CPDM to a computer, and then transmitting it electronically to MSHA takes a certified person, earning \$28.13 per hour, 6 minutes (0.1 hours). Since a new CPDM filter must be used with every part 90 miner sample, the number of part 90 miner samples to validate, certify and transmit to MSHA is the same as the number of CPDMs filters derived in Chapter IV of this document. The estimate of the number of times that a certified person must validate, certify and transmit part 90 miner sampling data from a CPDM to MSHA will be: none in the first year that the final rule is in effect; 10 times in the second year that the final rule is in effect; and 20 times in the third year, and every year thereafter, that the final rule is in effect. The first, second and third year burden hours and hour burden costs for surface coal mines are shown below:

First Year of Final Rule

There are no burden hours or hour burden costs for validating, certifying and transmitting sampling data from CPDMs used to perform part 90 miner sampling at surface coal mines in the first year that the rule is in effect.

Second Year of Final Rule

The second year burden hours and hour burden costs for surface coal mines are shown below:

<u>Burden Hours</u>	
2,000 samples x 0.1 hrs.	= 200 hrs.
<u>Hour Burden Costs</u>	
200 hrs. x \$28.13 wage rate	= \$5,626

Third Year of Final Rule and Every Year Thereafter

The third year burden hours and hour burden costs for surface coal mines are shown below:

<u>Burden Hours</u>	
4,000 samples x 0.1 hrs.	= 400 hrs.
<u>Hour Burden Costs</u>	
400 hrs. x \$28.13 wage rate	= \$11,252

Sign and Provide CPDM Sampling Data to Part 90 Miners

Final § 90.209(b) requires operators to provide copies of the MSHA reports of sampling data received by the operator under final § 90.209(a) to part 90 miners. In addition, final § 90.209(c) requires that when using a CPDM, operators must print, sign, and provide each part 90 miner a paper record (Dust Data Card) of the sample run for the part 90 miner which includes: 1) the mine identification number; the location within the mine from which the sample was taken; 2) the location within the mine from which the samples were taken; 3) the concentration of respirable dust, expressed as an equivalent 8-hour concentration reported and stored for each sample; 4) the sampling status conditions encountered for each sample; 5) the shift length; and 6) the part 90 miner's MSHA Individual Identification Number (MIIN). This information is included on the CPDM Dust Data Card. MSHA assumes that providing the part 90 miner with the MSHA report under final § 90.209(b) and the Dust Data Card of the sample run under final § 90.209(c) can be done at the same time.

Final § 90.201(f) requires the operator make a record showing the length of each shift for each part 90 miner, retain the records for at least six months, make them available for inspection by authorized representatives of the Secretary, and submit them to the MSHA District Manager when requested in writing. MSHA assumes that after recording the shift length on the Dust Data Card under final § 90.209(c), the operator then records the shift length in a book to comply with final § 90.201(f). The burden to record shift length for part 90 miners required by final § 90.201(f) is accounted for in the burden for final § 90.209(c).

A new CPDM filter is used every time a CPDM is used to sample and a Dust Data Card with the information noted above is generated after the sample is taken. Thus, the number of times Dust Data Cards will be provided to part 90 miners is equal to the number of CPDM filters derived in Chapter IV of this document. Sampling data under final § 90.209(b) and (c) can be provided to the part 90 miner at the same time. MSHA estimates that a certified person, earning \$28.13 per hour, takes 3 minutes (0.05 hours) to perform the functions described above and make a copy of the sampling data. The first, second and third year burden hours and hour burden costs for surface coal mines are shown below:

First Year of Final Rule

There are no burden hours or hour burden costs to print, sign and provide to part 90 miners the sampling data from CPDMs used to sample part 90 miners at surface coal mines in the first year that the rule is in effect.

Second Year of Final Rule

The second year burden hours and hour burden costs for surface coal mines are shown below:

Burden Hours

2,000 sampling data records provided to part 90 miner
x 0.05 hrs. = 100 hrs.

Hour Burden Costs

$$100 \text{ hrs.} \times \$28.13 \text{ wage rate} = \$2,813$$

Third Year of Final Rule and Every Year Thereafter

The third year burden hours and hour burden costs for surface coal mines are shown below:

Burden Hours

$$\begin{array}{l} 4,000 \text{ sampling data records provided to part 90 miner} \\ \times 0.05 \text{ hrs.} \end{array} = 200 \text{ hrs.}$$

Hour Burden Costs

$$200 \text{ hrs.} \times \$28.13 \text{ wage rate} = \$5,626$$

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APPENDIX - A

Estimate of the Number of Required Corrective Actions and Determinations of Noncompliance

MSHA expects that operators will put in place additional engineering controls to comply with the final rule. During the first few years that the final rule is in effect, operators will have to make adjustments to these engineering controls as they become more familiar with the appropriate controls. During this transition, MSHA expects that operators will be required to take more corrective actions and will also receive more citations for coal mine dust overexposures than under the existing standards.

Estimate of the Number of Required Corrective Actions and Determinations of Noncompliance at Underground Coal Mines

Under the final rule, determinations of noncompliance will be different for operator and MSHA inspector samples. For MSHA inspector samples, noncompliance determinations will be based on a single sample meeting or exceeding the Excessive Concentration Value (ECV). For operator samples, all determinations will be based upon valid representative samples in a sampling period. For operator sampling, noncompliance will be based on the average of multiple operator samples (5 for the first 18 months and 15 thereafter for DOs and ODOs) meeting or exceeding the ECV. Additionally, noncompliance will also be based on samples of 2 or more during the first 18 months (using the gravimetric sampler) and 3 or more thereafter (using the CPDM) meeting or exceeding the ECV in a sampling period. Depending on the sampling device and where the sample is taken, operators will be required to take corrective actions when 1 of 5 samples in a sampling period and when 1 or 2 of 15 samples in a sampling period meet or exceed the ECV. MSHA made a minor corresponding change to the methodology used in the proposal to project each of these situations.

Projections Based on Operator Samples

For the proposed rule, MSHA used the experience gained during the 1998 Interim Single-Sample Enforcement Policy (ISSEP) to assess the impact of basing noncompliance determinations on single samples. In addition, for the proposal, MSHA assumed that there would be 52 determinations of noncompliance per shift per year (i.e., one per shift per week for 52 weeks).

Several commenters questioned MSHA's approach to projecting noncompliance under the proposed rule, particularly the assumption that only one noncompliance determination would be made per shift per week. Some commenters, for example, indicated that under the proposed rule noncompliance determinations would be made on every shift.

MSHA had to significantly revise the methodology to project noncompliance under the final rule due to the changes from the proposed rule. Rather than basing the estimates on the ISSEP experience, MSHA used operator MSIS data from 2008 and 2009. Table A-1 presents a

summary of those data adjusted for sampling during normal production.²⁸ Since operator data on shuttle cars was limited and since some operators will have to sample shuttle car operators under the final rule (i.e., those using blowing and split ventilation), MSHA used adjusted 2008-2009 inspector data on shuttle car operators. The percentage of samples meeting or exceeding the applicable standard is the percentage of adjusted samples at or above the 2.0 (or 1.5) mg/m³ standard or the reduced standard below 2.0 (or 1.5) mg/m³ that was in effect at the time the sample was taken.

Table A-1: Summary of 2008 and 2009 MSIS Operator Samples Adjusted for Normal Production

Occupation	Number of Samples	Percentage Meeting or Exceeding the ECV for the Applicable Standard		Mean	Standard Deviation
		2.0 mg/m ³	1.5 mg/m ³		
Longwall DO	2,481	11%	21%	1.33	0.80
NonLongwall DO	48,760	7%	11%	0.86	0.95
Other	81	4%	5%	0.78	0.95
Roof Bolter	2,195	7%	9%	0.70	0.74
Shuttle Car Operator	11,867	3%	5%	0.68	0.94
Total	65,384	6%	10%	0.84	0.94

For the proposed rule, MSHA assumed that as mine operators and miners become familiar with the proposed methods of determining noncompliance based on full-shift single samples taken during normal production, the number of samples meeting or exceeding the ECV would decline by approximately 20 percent per sampling period during the first year when the gravimetric sampler would still be used. Some commenters questioned what effect that assumption would have on the sample distribution over time. Several commenters felt that the reductions projected by MSHA were unrealistic and that more violations were likely under the proposed rule than MSHA estimated.

In response to these comments and changes in the final rule, MSHA revised its methodology for projecting reductions in dust levels while the gravimetric sampler is in use. Based on its technological feasibility assessment (see the preamble to the final rule) and the experience of field staff, MSHA projects that mine operators will reduce overall dust levels by approximately 2 percent during each bimonthly sampling period that the gravimetric sampler is in use, a total of 9 sampling periods. For the first sampling period, MSHA assumed that the dust levels will be equal to those in 2008-2009. For each of the remaining 8 sampling periods during the first 18 months, MSHA reduced each adjusted sample by 2 percent and recalculated the summary statistics. MSHA notes that under this approach the percentage of samples meeting or

²⁸ Each sample was multiplied by 1.16 (non-longwall) and 1.09 (longwall) to account for the change in the definition of normal production shift. The derivation of these factors was previously presented in the feasibility assessment of the PREA and the preamble to the final rule.

exceeding the ECV for the 2.0 mg/m³ standard is projected to decline by approximately 43 percent over the entire 18 month period as compared to the approach used for the proposed rule which projected a decline of 87 percent during the first year.

Most of the engineering controls and work practices required to meet the 1.5 mg/m³ standard will likely be implemented during the first 18 months that the final rule is in effect. When the gravimetric sampler is replaced by the CPDM, operators will be able to fine tune these controls because they will be able to determine dust levels correlated to specific activities during the shift because the CPDM will be able to deliver real time results.

For the proposed rule, MSHA projected that the number of times the ECV would be met or exceeded would decline by approximately 2.0 percent per week as operators become familiar with the CPDM. Some commenters suggested that the proposed rule would result in more citations than projected by MSHA because the proposed 24/7 monitoring requirement when the CPDM is in use combined with noncompliance determinations based upon single operator samples would result in multiple citations per mine in a week rather than the single citation per mine per week projected by MSHA. In response to these comments, both of these proposed requirements were changed in the final rule.

For the final rule, MSHA assumed that operators will use the CPDM to concentrate on situations that may lead to dust levels at or above the standard since the final rule requires corrective action anytime a samples meets or exceeds. As a result, the probability of meeting or exceeding the standard will further decline after the CPDM goes into use after the first 18 months. Based on the technological feasibility assessment (see the preamble to the final rule) and experience of field staff, MSHA projects that under the final rule samples at or above the applicable standard (either the 2.0 mg/m³ or 1.5 mg/m³ standard or a reduced standard below that level) will decline by approximately 4 percent during each quarterly sampling period that the CPDM is in use. MSHA projects that operators will have fully adapted to the new standard and the use of the CPDM by the end of the fourth year, after which time dust levels will remain fairly constant.

Based upon this analysis, the percentage of samples meeting or exceeding the ECV under a 1.5 mg/m³ standard is projected to decline by approximately 59 percent under the final rule during years three and four. Under the proposed rule a decline of 65 percent was projected during the single year (i.e., year two) that the 1.5 mg/m³ standard would have been in effect.

Tables A-2 and A-3 present the projected means, Tables A-4 and A-5 present the standard deviations and Tables A-6 and A-7 present the percentage of samples that meet or exceed the ECV for 2.0 mg/m³ (or 1.5 mg/m³) or a reduced standard below 2.0 mg/m³ (or 1.5 mg/m³) that was in effect at the time the sample was taken.

**Table A-2: Projected Mean Exposures During the First 2 Years
Following the Promulgation of the Final Rule**

Occupation	Sampling Period										
	1	2	3	4	5	6	7	8	9	10	11
Longwall DO	1.33	1.31	1.28	1.25	1.23	1.20	1.18	1.16	1.13	1.12	1.11
NonLongwall DO	0.86	0.85	0.83	0.81	0.80	0.78	0.77	0.75	0.74	0.73	0.72
Other	0.78	0.76	0.75	0.73	0.72	0.70	0.69	0.68	0.66	0.66	0.65
Roof Bolter	0.70	0.69	0.68	0.66	0.65	0.64	0.62	0.61	0.60	0.59	0.59
Shuttle Car Operator	0.68	0.67	0.66	0.64	0.63	0.62	0.61	0.59	0.58	0.58	0.58
Total	0.84	0.83	0.81	0.79	0.78	0.76	0.75	0.73	0.72	0.71	0.70

**Table A-3: Projected Mean Exposures During Years 3 and 4
Following the Promulgation of the Final Rule**

Occupation	Sampling Period							
	12	13	14	15	16	17	18	19
Longwall DO	1.10	1.08	1.07	1.05	1.04	1.04	1.03	1.02
NonLongwall DO	0.71	0.70	0.69	0.69	0.68	0.67	0.67	0.66
Other	0.64	0.64	0.63	0.62	0.62	0.61	0.61	0.60
Roof Bolter	0.58	0.57	0.57	0.56	0.56	0.55	0.55	0.55
Shuttle Car Operator	0.57	0.57	0.57	0.56	0.56	0.56	0.56	0.56
Total	0.70	0.69	0.68	0.67	0.67	0.66	0.66	0.65

Table A-4: Projected Standard Deviation During the First 2 Years Following the Promulgation of the Final Rule

Occupation	Sampling Period										
	1	2	3	4	5	6	7	8	9	10	11
Longwall DO	0.8041	0.7880	0.7723	0.7568	0.7417	0.7269	0.7123	0.6981	0.6841	0.6588	0.6361
NonLongwall DO	0.9483	0.9293	0.9107	0.8925	0.8747	0.8572	0.8400	0.8232	0.8068	0.7795	0.7543
Other	0.9488	0.9299	0.9113	0.8930	0.8752	0.8577	0.8405	0.8237	0.8072	0.7765	0.7472
Roof Bolter	0.7435	0.7286	0.7140	0.6998	0.6858	0.6720	0.6586	0.6454	0.6325	0.6127	0.5943
Shuttle Car Operator	0.9366	0.9179	0.8995	0.8815	0.8639	0.8466	0.8297	0.8131	0.7968	0.7702	0.7453
Total	0.9427	0.9238	0.9054	0.8872	0.8695	0.8521	0.8351	0.8184	0.8020	0.7752	0.7503

**Table A-5: Projected Standard Deviation During Years 3 and 4
Following the Promulgation of the Final Rule**

Occupation	Sampling Period							
	12	13	14	15	16	17	18	19
Longwall DO	0.6063	0.5791	0.5544	0.5322	0.5124	0.4948	0.4794	0.4671
NonLongwall DO	0.7258	0.6993	0.6748	0.6523	0.6314	0.6123	0.5948	0.5793
Other	0.7178	0.6897	0.6630	0.6376	0.6134	0.5904	0.5697	0.5500
Roof Bolter	0.5739	0.5552	0.5380	0.5225	0.5085	0.4956	0.4841	0.4740
Shuttle Car Operator	0.6942	0.6709	0.6492	0.6290	0.6101	0.5924	0.5762	0.6432
Total	0.6962	0.6721	0.6499	0.6294	0.6105	0.5932	0.5779	0.6393

Table A-6: Projected Portion Meeting or Exceeding the ECV for 2.0 mg/m³ or Lower Applicable Standard During the First 2 Years Following the Promulgation of the Final Rule

Occupation	Sampling Period										
	1	2	3	4	5	6	7	8	9	10	11
Longwall DO	10.6%	10.0%	9.4%	8.7%	7.9%	7.5%	7.0%	6.6%	6.1%	5.4%	4.6%
NonLongwall DO	7.0%	6.7%	6.4%	6.1%	5.9%	5.6%	5.4%	5.2%	4.9%	4.5%	4.1%
Other	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%
Roof Bolter	7.1%	6.8%	6.7%	6.5%	6.2%	5.9%	5.6%	5.2%	5.0%	4.6%	4.2%
Shuttle Car Operator	2.6%	2.3%	2.2%	2.1%	1.9%	1.9%	1.7%	1.6%	1.5%	1.3%	1.2%
Total	6.3%	6.0%	5.8%	5.5%	5.3%	5.0%	4.8%	4.6%	4.4%	3.9%	3.6%

These estimates are based on a reduction of 2% per sample using Gravimetric Sampler during first 18 months

These estimates are based on a reduction of 4% per sample for every sample over 2.0 mg/m³ using CPDM after 18 months.

5 Samples taken Bi-Monthly with the Gravimetric Sampler during first 18 months for Periods 1 through 9.

15 Samples taken Quarterly with the CPDM after 18 months for Periods 10 through 19.

Table A-7: Projected Portion Meeting or Exceeding the ECV for 1.5 mg/m³ or Lower Applicable Standard During Years 3 and 4 Following the Promulgation of the Final Rule

Occupation	Sampling Period							
	12	13	14	15	16	17	18	19
Longwall DO	11.7%	9.2%	6.7%	5.7%	5.1%	4.4%	3.7%	3.3%
NonLongwall DO	6.8%	6.0%	4.9%	4.4%	4.0%	3.7%	3.3%	2.9%
Other	4.9%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%
Roof Bolter	5.1%	4.4%	3.8%	3.4%	3.2%	2.7%	2.5%	2.4%
Shuttle Car Operator	2.1%	1.7%	1.3%	1.0%	0.9%	0.8%	0.7%	0.6%
Total	6.1%	5.3%	4.2%	3.8%	3.5%	3.1%	2.8%	2.5%

These estimates are based on a reduction of 4% per sample for every sample over 1.5 mg/m³ using CPDM.

Quarterly Sampling with the CPDM.

MSHA used the sample distributions resulting from the projected reductions described above to estimate the probability of noncompliance in each sampling period based on operator samples. This required a multistep process since under the final rule noncompliance determinations based on operator samples will be made in a sampling period both on the average of multiple samples meeting or exceeding the ECV and on multiple samples meeting or exceeding the ECV. According to the Central Limit Theorem, regardless of the population frequency distribution, the mean and standard deviation of independently selected distributions of random samples will be normally distributed around the population mean and standard deviation. This allows MSHA to estimate the probability that a sample mean would meet or exceed the ECV based on the following formula:

$$T = \frac{(ECV - \text{Mean of 2008-2009 sample data}) * \text{SQRT}(\text{Sample Size})}{\text{Standard Deviation of 2008-2009 sample data}}$$

Where:

T = the number to be evaluated using a one-tail Student T distribution

ECV = 2.15 for 5 gravimetric samples and standard of 2.0, 2.12 for 5 CPDM samples and standard of 2.0, and 1.56 for 15 CPDM samples and standard of 1.5

Sample Size = 5 for first 18 months (periods 1-9) and 15 thereafter

MSHA estimated the probability that 2 or more out of 5 valid, representative samples during the first 18 months will meet or exceed the ECV based on the assumption that each sample was independent using the following formula:

$$\begin{aligned} \text{Prob}_{2+ \text{ of } 5} &= 1 - \text{Prob}_0 - \text{Prob}_1 \\ \text{Prob}_{2+ \text{ of } 5} &= 1 - (1 - \text{Prob}_{\text{Exceed}})^5 - 5 \times \text{Prob}_{\text{Exceed}} \times (1 - \text{Prob}_{\text{Exceed}})^4 \end{aligned}$$

Where:

$\text{Prob}_{2+ \text{ of } 5}$ = Probability that 2 or more out of 5 samples meet or exceed ECV

Prob_0 = Probability that 0 out of 5 samples meet or exceed ECV

Prob_1 = Probability that 1 out of 5 samples meet or exceed ECV

$\text{Prob}_{\text{Exceed}}$ = Probability that a sample will meet or exceed ECV from Table A-6

Similarly, MSHA used the following formula to estimate the probability that 3 or more out of 15 valid, representative samples will meet or exceed the ECV:

$$\begin{aligned} \text{Prob}_{3+ \text{ of } 15} &= 1 - \text{Prob}_0 - \text{Prob}_1 - \text{Prob}_2 \\ \text{Prob}_{3+ \text{ of } 15} &= 1 - (1 - \text{Prob}_{\text{Exceed}})^{15} - 15 \times \text{Prob}_{\text{Exceed}} \times (1 - \text{Prob}_{\text{Exceed}})^{14} - \\ &\quad 105 \times \text{Prob}_{\text{Exceed}}^2 \times (1 - \text{Prob}_{\text{Exceed}})^{13} \end{aligned}$$

Where:

$\text{Prob}_{3+ \text{ of } 15}$ = Probability that 3 or more out of 15 samples meet or exceed ECV

Prob_0 = Probability that 0 out of 15 samples meet or exceed ECV

Prob_1 = Probability that 1 out of 15 samples meet or exceed ECV

Prob_2 = Probability that 2 out of 15 samples meet or exceed ECV

$\text{Prob}_{\text{Exceed}}$ = Probability that a sample will meet or exceed ECV from Tables A-6 and A-7

Variations of these two formulas were also used to project the probability that corrective actions would be needed due to 1 out of 5 valid, representative samples ($\text{Prob}_{1 \text{ out of } 5} = 5 \times \text{Prob}_{\text{Exceed}}$) and 1 or 2 out of 15 valid, representative samples meeting or exceeding the ECV ($\text{Prob}_{1 \text{ or } 2 \text{ of } 15} = 15 \times \text{Prob}_{\text{Exceed}} \times (1 - \text{Prob}_{\text{Exceed}})^{14} + 105 \times \text{Prob}_{\text{Exceed}}^2 \times (1 - \text{Prob}_{\text{Exceed}})^{13}$).

Tables A-8 and A-9 present the estimates of the portion of samples means that are projected to meet or exceed the ECVs for the 2.0 and 1.5 mg/m³ standards in each sampling period. Tables A-10 and A-11 present the estimates of the portion of groups of 5 samples with 2 or more valid, representative samples projected to meet or exceed the ECV and groups of 15 samples with 3 or more valid, representative samples projected to meet or exceed the ECV in each sampling period. MSHA believes that it is significantly more likely that groups of samples with means meeting or exceeding the ECV have multiple samples meeting or exceeding the ECV, than it is for these two events to be independent of one another. Therefore, MSHA projected the probability of noncompliance in each sampling period by taking the greater of the probability that the sample mean will meet or exceed the ECV and the probability that either 2 or more out of 5 valid, representative samples or 3 or more out of 15 valid, representative samples will meet or exceed the ECV.

Since all of the estimates in Tables A-10 and A-11 are greater than the corresponding estimates in Tables A-8 and A-9, the estimates in Tables A-10 and A-11 also represent MSHA's best projections of noncompliance under the final rule.

Table A-8: Portion of Operator Periodic Sampling Results with Mean Meeting or Exceeding the ECV for 2.0 mg/m³ Standard During the First 2 Years Following Promulgation of the Final Rule

Occupation	Sampling Period										
	1	2	3	4	5	6	7	8	9	10	11
Longwall DO	4.3%	3.7%	3.3%	2.9%	2.5%	2.2%	1.9%	1.7%	1.5%	0.0%	0.0%
NonLongwall DO	1.9%	1.7%	1.6%	1.4%	1.3%	1.2%	1.1%	1.0%	0.9%	0.0%	0.0%
Other	1.6%	1.4%	1.3%	1.2%	1.1%	1.0%	0.9%	0.8%	0.7%	0.0%	0.0%
Roof Bolter	0.6%	0.5%	0.5%	0.4%	0.4%	0.4%	0.3%	0.3%	0.3%	0.0%	0.0%
Shuttle Car Operator	1.2%	1.1%	1.0%	0.9%	0.9%	0.8%	0.7%	0.6%	0.6%	0.0%	0.0%
Total	1.8%	1.6%	1.5%	1.3%	1.2%	1.1%	1.0%	0.9%	0.8%	0.0%	0.0%

ECV of 2.15 for Bi-Monthly Sampling of 5 samples during first 18 months for Periods 1 through 9.

ECV of 2.07 for Quarterly Sampling of 15 samples for Periods 10 and 11.

Table A-9: Portion of Operator Periodic Sampling Results with Mean Meeting or Exceeding the ECV for 1.5 mg/m³ Standard During Years 3 and 4 Following the Promulgation of the Final Rule

Occupation	Sampling Period							
	12	13	14	15	16	17	18	19
Longwall DO	0.5%	0.3%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%
NonLongwall DO	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Other	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Roof Bolter	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Shuttle Car Operator	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

ECV of 1.56 for Quarterly Sampling of 15 samples for Periods 12 through 19.

Table A-10: Portion of Operator Periodic Sampling Results with 2 or More Out of 5 Valid Representative Samples with the Gravimetric Sampler and 3 or More Out of 15 Valid Representative Samples with the CPDM Meeting or Exceeding the ECV for 2.0 mg/m³ Or Lower Applicable Standard During the First 2 Years Following the Promulgation of the Final Rule

Occupation	Sampling Period										
	1	2	3	4	5	6	7	8	9	10	11
Longwall DO	9.1%	8.1%	7.2%	6.3%	5.4%	4.9%	4.2%	3.8%	3.3%	4.4%	2.8%
NonLongwall DO	4.2%	3.9%	3.6%	3.3%	3.1%	2.8%	2.6%	2.4%	2.2%	2.7%	2.1%
Other	1.6%	1.4%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.7%	1.7%
Roof Bolter	4.3%	4.1%	3.9%	3.7%	3.4%	3.1%	2.8%	2.5%	2.2%	2.9%	2.3%
Shuttle Car Operator	1.2%	1.1%	1.0%	0.9%	0.9%	0.8%	0.7%	0.6%	0.6%	0.1%	0.1%
Total	3.5%	3.2%	3.0%	2.7%	2.5%	2.3%	2.1%	1.9%	1.7%	1.9%	1.5%

Bi-Monthly Sampling of 5 samples during first 18 months for Periods 1 through 9.

Quarterly Sampling of 15 samples after 18 months for Periods 10 through 19.

Table A-11: Portion of Operator Quarterly Results with 3 or More Out of 15 Valid Representative Samples Meeting or Exceeding the ECV for 1.5 mg/m³ or Lower Applicable Standard During Years 3 and 4 Following the Promulgation of the Final Rule

Occupation	Sampling Period							
	12	13	14	15	16	17	18	19
Longwall DO	25.4%	15.4%	7.3%	5.1%	3.8%	2.6%	1.7%	1.2%
NonLongwall DO	7.8%	5.6%	3.4%	2.6%	2.1%	1.6%	1.2%	0.9%
Other	3.5%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%
Roof Bolter	3.7%	2.6%	1.7%	1.3%	1.1%	0.7%	0.6%	0.5%
Shuttle Car Operator	0.3%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
Total	5.9%	4.1%	2.4%	1.8%	1.4%	1.1%	0.8%	0.6%

Quarterly Sampling of 15 samples.

Table A-12: Portion of Periodic Operator Sampling Results with Exactly 1 Out of 5 Valid Representative Samples or 1 or 2 Out of 15 Valid Representative Samples Meeting or Exceeding the ECV for Applicable Standard During the First 2 Years Following the Promulgation of Final Rule

Occupation	Sampling Period										
	1	2	3	4	5	6	7	8	9	10	11
Longwall DO	33.9%	32.7%	31.6%	30.2%	28.5%	27.5%	26.1%	25.0%	23.8%	52.1%	47.4%
NonLongwall DO	26.1%	25.4%	24.7%	23.8%	23.1%	22.4%	21.6%	20.9%	20.2%	47.0%	44.3%
Other	15.9%	15.9%	15.9%	15.9%	15.9%	15.9%	15.9%	15.9%	15.9%	41.5%	41.5%
Roof Bolter	26.3%	25.7%	25.4%	24.8%	24.0%	23.1%	22.4%	21.1%	20.3%	47.5%	45.1%
Shuttle Car Operator	11.5%	10.6%	10.0%	9.6%	9.0%	8.7%	8.0%	7.5%	7.0%	17.9%	16.4%
Total	24.3%	23.5%	22.8%	21.9%	21.2%	20.5%	19.7%	19.0%	18.2%	43.3%	40.6%

Bi-Monthly Sampling of 5 samples during first 18 months for Periods 1 through 9.

Quarterly Sampling of 15 samples after 18 months for Periods 10 through 19.

Table A-13: Portion of Operator Quarterly Results with 1 or 2 Out of 15 Valid Representative Samples Meeting or Exceeding the ECV for Applicable Standard During Years 3 and 4 Following the Promulgation of the Final Rule

Occupation	Sampling Period							
	12	13	14	15	16	17	18	19
Longwall DO	59.2%	61.1%	57.0%	53.6%	50.7%	46.4%	41.6%	38.0%
NonLongwall DO	57.6%	54.6%	49.3%	46.6%	44.0%	41.3%	38.1%	35.2%
Other	49.7%	41.6%	41.6%	41.6%	41.6%	41.6%	41.6%	41.6%
Roof Bolter	50.4%	46.6%	42.2%	39.3%	37.4%	32.9%	31.1%	29.7%
Shuttle Car Operator	26.7%	22.4%	17.6%	14.5%	13.1%	11.8%	9.9%	8.4%
Total	55.1%	51.4%	45.5%	42.4%	39.8%	37.0%	33.9%	31.1%

Quarterly Sampling of 15 samples.

Projections Based on Inspector Samples

MSHA used the 2008 – 2009 inspector samples to project the probability that single inspector samples will result in determinations of noncompliance. Approximately 5.0 percent of adjusted inspector samples taken at non-longwall operations and 13.1 percent of adjusted inspector samples taken at longwall operations met or exceeded the ECV for 2.0 mg/m³ or the ECV for the reduced standard in effect at the time the sample was taken. Based on the assumption that the dust controls put into effect to reduce the operator samples will have a similar effect on inspector samples, MSHA used the projected decline in operator samples meeting or exceeding the ECV during the first 2 years that the final rule will be in effect to project the declines in inspector samples meeting or exceeding the ECV. Based on the analysis presented above, MSHA projects that the portion of operator longwall DO samples meeting or exceeding the ECV will decline from 10.6 percent to 4.6 percent (i.e., a decline of 57 percent) and the portion of operator non-longwall DO samples meeting or exceeding the ECV will decline from 7.0 percent to 4.1 percent (i.e., a decline of 41 percent). MSHA applied these reductions to the inspector percentages to arrive at the projections in Table A-14.

**Table A-14: Portion of Inspector Samples Meeting or Exceeding the ECV
for Applicable Standard During the First 2 years
Following the Promulgation of the Final Rule**

Operation	Sampling Period							
	1	2	3	4	5	6	7	8
Longwall	7.5%	6.3%	5.2%	4.4%	3.6%	3.0%	2.5%	2.1%
NonLongwall	3.6%	3.4%	3.3%	3.1%	3.0%	2.8%	2.7%	2.6%

Next MSHA used the differential in the 2008-2009 data from the portion of inspector samples meeting or exceeding the ECV for 2.0 mg/m³ and 1.5 mg/m³. For longwall operations 13.1 percent of samples met or exceeded the ECV for 1.5 mg/m³ (162 percent more than met or exceeded 2.0 mg/m³) and for non-longwall operations 6.3 percent of samples met or exceeded the ECV for 1.5 mg/m³ (75 percent more than met or exceeded 2.0 mg/m³). Therefore, MSHA increased the portion of samples meeting or exceeding the ECV in period 9 when the 1.5 mg/m³ standard is scheduled to take effect by these percentages.

MSHA used the same basic methodology to project the decreases in the subsequent sampling periods as was used to project the reductions during the first two years. Based on the analysis presented above, MSHA projects that the portion of operator longwall DO samples meeting or exceeding the ECV will decline from 11.7 percent to 3.3 percent (i.e., a decline of 72 percent) and the portion of operator non-longwall DO samples meeting or exceeding the ECV will decline from 6.8 percent to 2.9 percent (i.e., a decline of 57 percent). MSHA applied these reductions to the inspector percentages to arrive at the projects in Table A-15.

**Table A-15: Portion of Inspector Samples Meeting or Exceeding the ECV
for Applicable Standard During Years 3 and 4
Following the Promulgation of the Final Rule**

Operation	Sampling Period							
	9	10	11	12	13	14	15	16
Longwall	7.5%	6.3%	5.2%	4.4%	3.6%	3.0%	2.5%	2.1%
NonLongwall	4.5%	4.0%	3.5%	3.1%	2.8%	2.5%	2.2%	1.9%

Projections for Outby DAs

Since MSHA did not receive comments on its estimates for the outby DAs, MSHA has retained those estimates in this analysis. Although the requirements in the final rule are responsive to comments and changes in the proposed rule, MSHA believes that retaining these estimates will have a negligible impact on the costs, given the small number of projected yearly instances of noncompliance involved.

Based on the technological feasibility analysis (see the preamble to the final rule) and an examination of the 2009 data, MSHA anticipates few additional noncompliance determinations at the outby DAs. In 2009, dust concentrations in the outby DAs averaged less than 1 mg/m³ and the compliance rate with the 2.0 mg/m³ standard exceeded 99.5 percent. As the technological feasibility analysis indicates, MSHA expects that mine operators will have little trouble complying with the proposed standard in the outby DAs. MSHA assumes a 1 percent rate of noncompliance in estimating the costs. Applying this rate to the 487 outby DAs and multiplying by 8 to account for the sampling periods each year (4 by the operator and 4 by MSHA) results in an estimate of 39 noncompliance determinations per year.

Derivation of Additional Citations in Underground Coal Mines

The projected number of underground citations, based on operator samples, was determined by taking the number of times that sampling periods occurred during the year for each non-longwall and longwall occupation sampled and multiplying them by the projected noncompliance percentage in Tables A-10 and A-11. Similarly, the number of total citations, based on inspector samples, was determined by taking the number of times that sampling periods occurred during each year for each non-longwall and longwall occupation and multiplying them by the projected noncompliance percentages in Table A-12. Table A-16 shows, by mine size, for underground coal mine operators the total estimate of citations generated from the above calculations for each year that the final rule is in effect.

The estimated number of citations for underground coal mine operators is shown below. The estimated additional citations decreases from the first year to the second year, increases in the third year, and then decreases in years four and five. The final rule requires the existing respirable coal mine dust standard of 2.0 mg/m³ to remain in effect the first two years (24 months) after the final rule is in effect, at which time the lower 1.5mg/m³ standard will go into effect. MSHA expects operators to install additional engineering controls during the first year of the final rule. As operators gain experience with these changes the Agency expects that citations in the second year will be lower than the first year since there is no change in the respirable dust standard. However, when the respirable coal mine dust standard is reduced in the third year to 1.5 mg/m³, MSHA expects citations to increase. As operators gain experience

operating under the lower respirable coal mine dust standard and with the additional engineering controls that have been installed, MSHA expects the number of citations to decrease.

**Table A-16: Total Number of Citations for Underground Coal Mine Operators
(Includes Baseline Figures)**

Mine Size	Year 1	Year 2	Year 3	Year 4	Year 5 & Every Year Thereafter
1-19	80	62	83	44	36
20-500	719	549	774	398	315
501+	93	73	131	57	43
Total	892	684	988	499	394

In calendar year 2009 the excessive dust violations at underground coal mines were: 17 citations for mines with 1-19 employees; 190 citations for mines with 20-500 employees; and 10 citations for mines with 501+ employees. MSHA used these citations as the baseline. Thus, Table A-17 shows, by mine size, for underground coal mine operators estimates of the additional citations expected to be generated by the final rule for underground coal mines when the baseline citations are removed from each year.

**Table A-17: Number of Additional Citations
for Underground Coal Mine Operators
Resulting from the Final Rule
(Excludes Baseline Figures)**

Mine Size	Year 1	Year 2	Year 3	Year 4	Year 5 & Every Year Thereafter
1-19	63	45	66	27	19
20-500	529	359	584	208	125
501+	83	63	121	47	33
Total	675	467	771	282	177

Samples That Require Corrective Action

The number of occasions when corrective action will be required to be taken when 1 out of 5 valid, representative samples in a sampling period, or 1 or 2 out of 15 valid, representative samples in a sampling period meet or exceed the ECV is determined in the following manner. MSHA took the number of times that sampling periods occurred during the year for each non-longwall and longwall occupation sampled and multiplied them by the projected percentages when 1 out of 5, valid, representative samples in a sampling period, or 1 or 2 out of 15 valid, representative samples in a sampling period, meet or exceed the ECV in Tables A-12 and A-13. Thus, Table A-18 shows, by mine size, for underground coal mine operators the estimate of the number of occasions, under the final rule, when operators will be required to take corrective actions when 1 out of 5 valid, representative samples in a sampling period, or 1 or 2 out of 15 valid, representative samples in a sampling period meet or exceed the ECV.

Table A-18: Number of Occasions When Underground Coal Mine Operators Must Take Corrective Action Due to Either 1 Out of 5 Valid Representative Samples or 1 or 2 Out of 15 Valid Representative Samples Meeting or Exceeding the ECV

Mine Size	Year 1	Year 2	Year 3	Year 4	Year 5 & Every Year Thereafter
1-19	179	253	378	269	237
20-500	1,617	2,296	3,544	2,497	2,188
501+	176	300	496	356	311
Total	1,972	2,849	4,418	3,122	2,736

Estimate of the Number of Noncompliance Determinations at Surface Coal Mines

Similar to the estimates of the outby DAs, MSHA retained the noncompliance estimates for surface coal mines from the proposal. Although the requirements in the final rule are responsive to comments and changes in the proposed rule, MSHA believes that retaining these estimates will have a negligible impact on the costs, given the small number of projected yearly instances of noncompliance involved.

MSHA used the experience gained during the 1998 Interim Single-Sample Enforcement Policy (ISSEP) to assess the impact of this proposed change. As was noted in the preamble to the Single Sample Proposed Rule (65 FR 42074), MSHA found only 14 of the 4,500 surface entities (0.3 percent) sampled during the ISSEP to be out of compliance with the 2.0 mg/m³ standard when determinations of noncompliance were based on single samples. Even though conditions have improved since ISSEP, MSHA used the noncompliance rate during that program to estimate the number of times the ECV would be met or exceeded under the final rule.

MSHA estimates that the final rule will increase the number of DWPs from 497 in 2009 to 3,019. MSHA applied the 0.3 percent rate during ISSEP to the 3,019 projected number of DWPs to arrive at a projection that the ECV would be met or exceeded an estimated 10 times per sampling period under the final rule.

The final rule will require operators to take full-shift samples rather than 8-hour samples. MSHA took 8-hour samples during ISSEP, so the estimate had to be adjusted to account for full-shift sampling. MSHA used 2009 operator samples to develop an adjustment factor. First MSHA determined that 40 individual 2009 samples were at or above the ECV for 2.0 mg/m³. This results an average of 10 operator samples at or above the ECV in a sampling period.

In the proposed rule, determinations of noncompliance could be based on a single operator sample or a single inspector sample. Under the final rule, single inspector samples will be used to make determinations of noncompliance but single operator samples will not. Rather, a single operator sample meeting or exceeding the ECV will require only corrective action. Two or more out of a group of five operator samples in a sampling period or the average of five operator samples in a sampling period will be required for a noncompliance determination. However, this methodology did not provide any basis to distinguish the small number of projected determinations of noncompliance from the small number of projected occasions when 1 out of 5 valid, representative samples in a sampling period will meet or exceed the ECV. Therefore, for costing purposes, MSHA considered all such occasions to be noncompliance and

estimated the costs accordingly. Since the costs associated with noncompliance are higher than the costs for taking corrective actions, this approach slightly overestimates the surface coal mine operators' costs. Given the small number of projected occasions (i.e., 10 per sampling period) and the magnitude of the costs involved, MSHA has determined that this overestimate is insignificant relative to the total compliance costs projected for surface coal mines.

Under the final rule, surface coal mine operators will have to sample DWPs four times each year. MSHA inspects surface coal mines twice per year. So there will be 6 sampling cycles per DWP each year. For the proposed rule, MSHA projected that the estimated number of noncompliance determinations would decline by 15 percent per sampling period, so that the number of noncompliance determinations would decline to 9 by the sixth sampling period, a reduction of 55 percent compared to the projected 10 noncompliance determinations in the first sampling period. For the final rule, MSHA projected the same 55 percent decline over two years, which resulted in a decline of 7 percent per sampling period rather than the 15 percent projected for the proposal.

After two years, the final rule will reduce the standard in the active workings of each surface coal mine to 1.5 mg/m³. As was done for the proposal, based on the 2009 data, MSHA estimates that the number of adjusted samples at or above the ECV would increase by 75 percent under a 1.5 mg/m³ standard. Multiplying the 5 citations projected in the last sampling period under the 2.0 mg/m³ standard (at the end of the second year) by 1.75, MSHA estimates that 8 citations would occur in the first sampling period under the 1.5 mg/m³ standard (beginning in the third year).

MSHA again projects that the estimate of the number of noncompliance determinations will decline by 7 percent per sampling period, so that the number of noncompliance determinations will decline to 7 by the end of four years, a reduction of 55 percent compared to the projected 16 noncompliance determinations in the first sampling period of the third year. This will result in a projected total of 24 noncompliance determinations per year beginning in the fifth year (i.e., 4 noncompliance determinations per sampling period X 6 sampling periods per year). Table A-19 shows the projected number of noncompliance determinations by year at surface coal mines.

**Table A-19: Total Number of Projected
Noncompliance Determinations
at Surface Coal Mines,
by Year (Includes Baseline Figures)**

Year	Sampling Period						Total
	1	2	3	4	5	6	
1	10	9	9	8	7	7	50
2	6	6	6	5	5	5	33
3	8	7	7	6	6	5	39
4	5	5	4	4	4	4	26
5	4	4	4	4	4	4	24

In calendar year 2009, there were 8 citations at surface coal mines (4 citations at mines with 1-19 employees; 3 citations at mines with 20-500 employees; and 1 citation at a mine with 501+ employees). MSHA used these citations as the baseline. Thus, Table A-20 shows, by mine size, the estimated number of additional noncompliance determinations under the final rule for surface coal mines (i.e., when baseline citations are removed from each year).

The number of estimated citations for surface coal mine operators is shown below. The estimated additional citations decreases from the first year to the second year, increases in the third year, and then decreases in years four and five. The final rule requires the existing respirable coal mine dust standard of 2.0 mg/m³ to remain in effect the first two years (24 months) after the final rule is in effect, at which time the lower 1.5mg/m³ standard will go into effect. MSHA expects operators to install additional engineering controls during the first year of the final rule. As operators gain experience with these changes, the Agency expects that citations in the second year will be lower than in the first year since there is no change in the respirable dust standard. However, when the respirable coal mine dust standard is reduced in the third year to 1.5 mg/m³, MSHA expects citations to increase. As operators gain experience operating under the lower respirable coal mine dust standard and with the additional engineering controls that have been installed, MSHA expects the number of citations to decrease.

**Table A-20: Number of Additional Citations
for Surface Coal Mines
Resulting from the Final Rule
(Excludes Baseline Figures)**

Mine Size	Year 1	Year 2	Year 3	Year 4	Year 5 & Every Year Thereafter
1-19	21	13	16	9	8
20-500	17	10	13	7	7
501+	4	2	3	2	1
Total	42	25	32	18	16

Estimate of the Number of Noncompliance Determinations for Part 90 Miners

These are currently fewer than 70 part 90 miners. Based on the feasibility analysis and an examination of the 2008 and 2009 data, MSHA does not anticipate an increase in the number of citations related to part 90 miners. Given the low exposures found in the sampling results for part 90 miners, the availability of areas with even lower respirable dust concentrations, and the required use of the CPDM, MSHA does not expect that operators will expose part 90 miners to dust levels above applicable standards.

APPENDIX - B

Uncertainty Analysis for Engineering Controls and Work Practices

The use of engineering controls and work practices available to mine operators to reduce miners' exposure to respirable coal mine dust are one of the more costly items in the final rule. The REA provides MSHA's preferred estimate concerning these costs. The Agency's preferred estimate is based on MSHA inspector experience, data collected during inspections, and public comments.

The agency used a discrete analysis to estimate costs since MSHA does not have the information to create probability distributions for each control and work practice. MSHA reviewed engineering controls and work practices to estimate an upper and lower bound for the controls or work practices. On the lower end of the range, many estimates were bounded by zero; therefore, these estimates are constrained. Upper side estimates were not constrained. Even without probability distributions, the preferred estimate is not the mean between the high and low estimates due to the constraints in the uncertainty analysis. MSHA believes the preferred estimate is the most likely outcome.

In some cases, the REA already has taken into account that mine operators use nearly all available engineering controls and work practices. In these instances, MSHA's preferred estimate shows that mine operators need to make few changes to comply with the final rule; therefore, there is little difference among the preferred, lower, or upper bound estimates. These cases mainly occur with respect to installing or modifying engineering controls and work practices that affect equipment at surface coal mines and surface areas of underground coal mines.

In other cases the preferred estimate shows that all mine operators need to install or modify a particular engineering control. In these cases, there are no differences between the preferred and upper bound estimates; however, MSHA included estimates less than the preferred for the lower bound. An example of this situation is adjusting regulators and fan blades in underground coal mines. The preferred estimate included all mines. As a result, the preferred and upper bound estimates are the same. The lower bound estimate assumes that 75 percent of the mines would need to adjust regulators and fan blades. Another example is the installation of headgate shield deflectors and scrubber systems on longwall mechanized mining units (MMUs) in underground coal mines. In this case, the preferred and upper bound estimates include all longwall MMUs in underground coal mines, while the lower bound estimate assumes that 75 percent of all longwall MMUs are impacted.

Table B-1 provides lower, preferred, and upper bound cost estimates resulting from the Agency's uncertainty analysis. Estimates are shown for underground coal mine operators, surface coal mine operators, and the totals for both. Table B-1 also shows how total costs would change in relation to the preferred, and the lower and upper bound estimates. As shown in Table B-1, annualized costs could be from 5.4 percent less to 21.7 percent more than the preferred annualized cost estimate. Tables B-2 and B-3 provide the costs by types of engineering control and work practice.

**Table B-1: Engineering Controls and Work Practices Uncertainty Analysis
(Annualized Cost Estimates in Millions)**

Cost Category, annualized values except where noted	Lower Bound	Preferred Estimate	Upper Bound
Underground Coal Mines - Engineering Controls & Work Practices	\$3.6	\$5.1	\$11.4
Surface Coal Mines - Engineering Controls & Work Practices	\$0.2	\$0.3	\$0.7
Total (Underground and Surface Coal Mines - Engineering Controls and Work Practices)	\$3.7	\$5.4	\$12.1
Total Difference from Preferred Estimate - Engineering Controls & Work Practices	-\$1.7	n/a	\$6.7
Total Annualized Costs of Final Rule	\$29.2	\$30.9	\$37.6
Percent Difference from Preferred Estimate	-5.4%	n/a	21.7%
Total Undiscounted Costs (45 years)	\$1,314.0	\$1,389.6	\$1,691.1

**Table B-2: Engineering Controls and Work Practices Uncertainty Analysis,
by Control and Work Practice, for Underground Coal Mines**

Types of Engineering Controls and Work Practices at Underground Coal Mines	Lower Bound Estimate	Preferred Estimate	Upper Bound Estimate
Engineering Controls and Work Practices for the Mine			
Adjust Fan Blades and/or Adjust Regulators	\$52,753	\$70,418	\$73,054
Water Pressure Pumps	\$232,715	\$269,010	\$704,550
Surface Areas of Underground Mines			
Refurbish Cabs on Equipment	\$976	\$976	\$3,904
Change Filters on Equipment	\$13,779	\$13,779	\$101,042
Repair Enclosures in Plants or Shops	\$143	\$143	\$287
Portable Exhaust Fan & Tubing in Plants and/or Shops	\$366	\$366	\$1,464
Engineering Controls and Work Practices for the MMU			
Adjust Water Sprays, increase Orifice Size, & Place Belting on Continuous Mining Machine	\$77,202	\$89,158	\$142,667
Sprays at Transfer Points	\$5,612	\$9,272	\$26,596
Exhaust Fans			
Exhaust Fans & Initial Tubing Required	\$629,520	\$996,740	\$2,282,010
Annual Increase in Electrical Cost for Exhaust Fans	\$735,000	\$1,160,000	\$2,585,000
Annual Replacement Costs for Tubing for Exhaust Fans	\$18,000	\$28,500	\$65,250
Install Dust Collectors on Continuous Mining Machines			
Change Scrubber Screen Size + Retrofit Dust Collector	\$13,908	\$26,889	\$53,778
Annual Costs to Purchase Bags for Dust Collectors	\$590,400	\$1,137,600	\$2,275,200
Cut to an Open Face for MMUs Operating on a Reduced Standard	\$926,330	\$926,330	\$2,778,990
For Longwall MMUs			
Adjust Water Sprays	\$20,496	\$20,496	\$20,496
Increase Orifice Size	\$8,198	\$8,198	\$8,198
Headgate Shield Deflectors	\$10,150	\$13,322	\$13,322
Headgate Scrubber System	\$234,240	\$307,440	\$307,440
Total Annualized Costs			
Total Annualized Costs	\$3,569,788	\$5,078,637	\$11,443,248

**Table B-3: Engineering Controls and Work Practices Uncertainty Analysis,
by Control and Work Practice, for Surface Coal Mines**

Types of Engineering Controls and Work Practices at Surface Coal Mines	Lower Bound Estimate	Preferred Estimate	Upper Bound Estimate
Install New Cab	\$7,808	\$13,664	\$27,328
Refurbish Cab	\$13,664	\$27,328	\$54,656
Repair Cab	\$161	\$321	\$643
Change Filters	\$148,137	\$291,785	\$583,570
Repair Enclosures in Plants	\$482	\$964	\$1,928
Portable Exhaust Fan & Tubing	\$1,464	\$1,464	\$3,660
Stationary Exhaust System	\$480	\$960	\$2,401
Total Annualized Costs	\$172,196	\$336,486	\$674,185